



National Parks
South Australia

Northern Flinders Ranges

Fire Management Plan 2016

Incorporating: Ikara-Flinders Ranges National Park, Vulkathunha-Gammon Ranges National Park, Ediacara Conservation Park, Bunkers Conservation Reserve and included Crown lands and participating Heritage Agreements



Department of Environment,
Water and Natural Resources



Ikara-Flinders Ranges National Park
Co-Management Board

Vulkathunha-Gammon Ranges National Park
Co-Management Board

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This Fire Management Plan is also available from: www.environment.sa.gov.au/fire/

Front Cover: Ikara (Wilpena Pound) by DEWNR

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July 2016



**Government
of South Australia**

Department of Environment,
Water and Natural Resources

ADNYAMATHANHA LANGUAGE GLOSSARY

Adnyamathanha	The traditional custodians of the Northern Flinders Ranges, meaning rock or hills people
Andu	Yellow-footed Rock-wallaby (<i>Petrogale xanthopus xanthopus</i>)
Awi Urtu	Permanent waterholes and springs
Idnya	Western Quoll (<i>Dasyurus geoffroii</i>)
Ikara	Adnyamathanha term for meeting place and is applied to Wilpena Pound
Mausa	House Mouse (<i>Mus musculus</i>)
Yura Muda	Creation stories, ceremonies and law
Naniguta	Feral Goat (<i>Capra hircus</i>)
Rabbit-a	European Rabbit (<i>Oryctolagus cuniculus</i>)
Urdlu	Kangaroo (<i>Macropus spp.</i>)
Vinba	Northern Cypress Pine (<i>Callitris glaucocephala</i>)
Virla	Common Brushtail Possum (<i>Trichosurus vulpecula</i>)
Vulkathunha	The Adnyamathanha word for old woman
Vusikata	Feral Cat (<i>Felis catus</i>)
Yura	The Adnyamathanha term meaning Aboriginal people
Yura Ngawarla	The language of the Adnyamathanha people
Vurndu	Smoke

Adnyamathanha language, known as Yura Ngawarla, is used where possible throughout the plan to name animals, plants, and places, and is followed by the English translation, then scientific name (where required). The use of Yura Ngawarla is at the request of the Adnyamathanha members of the Ikara–Flinders Ranges NP and Vulkathunha–Gammon Ranges NP Co-management Boards.

Glossary based upon Neville (2007) and Tunbridge (1991).

EXECUTIVE SUMMARY

This Fire Management Plan for the Northern Flinders Ranges includes four reserves: Ikara—Flinders Ranges National Park, Vulkathunha—Gammon Ranges National Park, Ediacara Conservation Park, and Bunkers Conservation Reserve, along with selected Crown land and participating Heritage Agreements. The Northern Flinders Ranges planning area is important for the Adnyamathanha community, who hold a strong spiritual connection with their country. This connection remains to this day and is important to Adnyamathanha people.

The plan has been prepared for the Co-management Boards of the Vulkathunha—Gammon Ranges National Park and the Ikara—Flinders Ranges National Park – a formal partnership between the Adnyamathanha people and the South Australian Government – by the Department of Environment, Water and Natural Resources (the Department). The aim of the plan is to facilitate fire management in the planning area, by supporting the fire aspirations of the Adnyamathanha community, and through the inclusion of strategies for bushfire risk minimisation and suppression on the included lands. The plan emphasises the protection of life and property, and provides direction for the protection and enhancement of the cultural and natural heritage of the area. It is important to note that there will be a transitional stage where the management strategies and works proposed in the plan are undertaken, and implementation depends upon fire management priorities and the allocation of regional resources.

The area was identified as a priority for fire management planning due to the potential of bushfire to threaten the community, especially that which supports the significant tourism industry and essential infrastructure of Wilpena and Virkundhunha (Balcanoona). The protection of significant Adnyamathanha cultural heritage, and threatened species and ecological communities from bushfires was also a priority for fire management planning.

The issues identified above were addressed during the planning process by:

- working with the Co-management Boards of the Ikara—Flinders Ranges and Vulkathunha—Gammon Ranges National Parks, and the Adnyamathanha Traditional Lands Association
- consulting with the Management Committee of the Bunkers Conservation Reserve
- undertaking a risk assessment to identify life, property, cultural, and environmental assets that may be threatened by bushfire
- applying the Department's Fire Management Zoning principles to guide the management of fuel in fire management zones
- applying the Department's Ecological Fire Management Guidelines to determine appropriate fire regimes in Conservation-Land Management zones
- assessing track standards using the Government Agencies Fire Management Working Group guidelines for firebreaks and fire access tracks in South Australia.

As a result of applying the above processes, the following recommendations have been identified.

- Fuel reduction, with an emphasis on the Adnyamathanha community undertaking many of these fuel management activities in consultation with the Department:
 - in Asset Protection and Bushfire Buffer zones using a variety of methods, including mechanical removal and prescribed burning

- in Bushfire Buffer zones to provide some landscape protection within the included lands
 - in strategic areas within the Conservation-Land Management zones to increase age-class variability within the vegetation across larger areas
 - to complement strategies in place to manage species or ecological communities.
- Fire management activities to increase fire readiness, including maintenance of fire access tracks.
 - Coordinated fire management between the Department, the Co-management Boards, the Adnyamathanha community and adjacent landowners.

The Co-management Boards and the Department thank those who contributed to the development of this plan and encourage their continued engagement in managing fire in the planning area. As fire is a landscape issue, the community will need to implement fire management strategies to complement work undertaken by the Co-management Boards and the Department.

The draft plan was released for public comment for a period of eleven weeks over November 2014 until January 2015. Comments were then evaluated and incorporated where considered appropriate. A major review of this plan will occur after ten years of implementation, or earlier if required.

CONTENTS

ADNYAMATHANHA LANGUAGE GLOSSARY	III
EXECUTIVE SUMMARY	IV
CONTENTS	VI
List of Figures	vii
List of Tables	vii
Fire Management Maps.....	vii
1 SCOPE AND PURPOSE.....	1
1.1 Objectives.....	2
2 THE PLANNING FRAMEWORK	5
2.1 Legislation	5
2.2 DEWNR Fire Management Policy	6
2.3 Other Influences and Considerations	7
2.4 Partnership Agencies.....	8
2.5 Consultation	9
2.6 Plan Review and Currency.....	9
3 BUSHFIRE ENVIRONMENT.....	10
3.1 Description of the Planning Area	10
3.2 Climate Change and Bushfire	13
3.3 Extreme Fire Conditions.....	14
3.4 Fire History	14
3.5 Vegetation Communities	15
3.6 Values and Assets	17
3.7 Abundant and Pest Species Management.....	28
4 RISK.....	32
4.1 Risk Assessment	32
4.2 Fuel Hazard.....	33
4.3 Potential for Fire Impact.....	36
5 READINESS	39
5.1 Equipment	39
5.2 Training	39
5.3 Risk Mitigation Strategies.....	39
5.4 Ecological Fire Management	45
6 RESPONSE	50
6.1 Response Plans	50
6.2 Suppression Considerations.....	50
6.3 Visitor Management during Bushfire	53
7 RECOVERY, RESEARCH AND MONITORING	55
7.1 Post-fire Rehabilitation and Recovery.....	55
7.2 Research.....	55
7.3 Monitoring.....	56
8 SUMMARY OF MANAGEMENT STRATEGIES	57
9 REFERENCE LIST	61
10 APPENDICES	66
Appendix 1 – Assets and Strategies for Risk Mitigation.....	66

Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species.....	72
Appendix 3 – Fire Response of Rated and Significant Fauna Species	81
Appendix 4 – Ecological Communities of Conservation Significance	88
Summary of Codes Used in Appendices.....	92
11 GLOSSARY OF ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY.....	93

List of Figures

Figure 1 – Northern Flinders Ranges Planning Area.....	10
Figure 2 – Fire Management Blocks	33
Figure 3 – Components of Fuel in Vegetation	34
Figure 4 – Approach for Determining Ecological Fire Management Guidelines.....	47

List of Tables

Table 1 – Legislation Influencing Fire Management Planning	5
Table 2 – Reserves Included in this Fire Management Plan.....	11
Table 3 – Other Lands Included in this Fire Management Plan	11
Table 4 – Dominant Species Layers for Major Vegetation Sub-groups.....	16
Table 5 – Fire Management Block Information	33
Table 6 – Likely Maximum Overall Fuel Hazard for MVS in the Planning Area	36
Table 7 – Ecological Fire Management Guidelines for MVS in the Planning Area	48

Fire Management Maps

Maps supporting this Fire Management Plan are interactive and are provided online via the web under five themes. To access this site please enter www.environment.sa.gov.au/fire/ into your internet browser and follow the links to 'Fire Management Maps'.

Fire Management Maps is designed to illustrate the text in the plans, particularly the works listed in Appendix 1, using five standard thematic maps. Users can view maps referred to in the text by selecting the appropriate theme. Data displayed on each map become more detailed at smaller scales. Once zoomed to an area of interest, it is possible to move between map themes and print maps up to A3 size. Please note that over time data displayed on Fire Management Maps may be more current than what is described in this Fire Management Plan.

The map themes are:

- Map 1 – Terrain, Tenure and Infrastructure
- Map 2 – Vegetation Communities
- Map 3 – Fire History
- Map 4 – Fire Management and Access
- Map 5 – Implementation Strategy – Proposed Burns

1 SCOPE AND PURPOSE

This plan provides a strategic framework for fire management in Co-managed reserves, Department of Environment, Water and Natural Resources (DEWNR)-managed lands, and other included lands that fall within the Northern Flinders Ranges planning area. The plan drives the delivery of fire management activities by defining objectives for the protection of life and property (particularly in relation to visitors and adjacent landholders), protection of cultural assets, protection of environmental assets, and for ecological fire management. Strategies are recommended to meet objectives, which will increase the level of bushfire readiness and guide management and suppression strategies during bushfire incidents.

It is not the intention of this strategy to replace or direct cultural fire management activities undertaken by Adnyamathanha people on Co-managed lands, whether executed by traditional or contemporary means. Rather, the strategy seeks to support the Adnyamathanha community to undertake cultural fire management and to use fire in cultural protocols. There are many similarities and differences between Adnyamathanha and non-Aboriginal ecological knowledge; to ensure a successful working relationship, all parties need to acknowledge and consider these respectfully.

The plan incorporates Ikara—Flinders Ranges and Vulkathunha—Gammon Ranges National Parks (NP), Ediacara Conservation Park (CP), Bunkers Conservation Reserve (CR), selected Crown land, and participating Heritage Agreements (HA).

The area was identified for fire management planning to address the following issues.

- The general protection of life, property, cultural values, and the environment within and adjacent to the reserves and other included lands.
- To support Adnyamathanha aspirations for fire and the protection of Adnyamathanha cultural values.
- The occurrence of species, populations, and ecological communities of conservation significance within the plan area.
- The large number of visitors during the fire season and associated infrastructure within the reserves.
- The likelihood of accidental fire ignitions, particularly in high use areas such as campgrounds, and the likelihood of intentional fire ignitions.
- The use of fire as a management tool for community protection and/or conservation management.
- The potential impact of a significant bushfire on the economy of local communities within the planning area.
- The potential impacts to biodiversity as a result of a reserve or block burning in its entirety in a single fire event.

This Fire Management Plan aims to:

- assess the level of bushfire risk (particularly in relation to the above issues) and the existing fire management and reserve management objectives
- identify objectives for fire management within the planning area
- outline strategies for risk mitigation and propose fire management actions to increase the level of bushfire readiness and guide bushfire suppression during incidents

- inform the preparation of Bushfire Response Plans for the included lands, which provide specific operational information useful in the early stages of an incident.

Fire management actions outlined in this plan will be implemented in a staged manner depending on available resources. These actions will be facilitated through the Co-management Boards, the DEWNR South Australian Arid Lands Region, and the Yellow-footed Rock-wallaby Preservation Association, and prioritised by the respective District (in this case, DEWNR's Ranges District) in liaison with the relevant Fire Management Officers.

Adjoining lands are considered in the plan, but only in the context of works required to minimise the risk to assets from fires originating in the included reserves. However, DEWNR will support and complement landscape-scale fire planning for adjoining lands. Fire management planning for lands not included in this plan is the responsibility of the Outback Bushfire Management Committee (BMC), in accordance with the requirements of the *Fire and Emergency Services Act 2005* (FES Act). DEWNR is represented on this committee.

1.1 Objectives

The fire management objectives that apply to all Co- and DEWNR-managed lands are as follows.

General Objectives for Fire Management

- To reduce the risk to life, property, and the environment during bushfire events.
- Protection of cultural values within Co- and DEWNR-managed lands.
- To ensure that sound conservation and land management principles are applied to fire management activities.
- To apply an adaptive management approach to fire management on Co- and DEWNR-managed lands supported by contemporary research and monitoring.
- To support the strategic containment of bushfires (i.e. to minimise the likelihood of a fire entering/exiting a block or reserve) and inhibit the spread of bushfire through Co- and DEWNR-managed lands.
- To complement Bushfire Management Area Plans prepared by Bushfire Management Committees under the FES Act.
- To undertake bushfire suppression in a safe and professional manner.
- To manage fire regimes to ensure consistency with the Ecological Fire Management Guidelines in Conservation-Land Management zones (Table 7).

The fire management objectives that apply specifically to the Northern Flinders Ranges Fire Management Plan are as follows.

Objectives for Fire Management in the Northern Flinders Ranges planning area

- To reduce the impact of bushfire in the reserves by:
 - minimising the likelihood of a substantial portion of a reserve burning in a single fire event

- minimising the likelihood of a landscape-scale fire occurring within the planning area or spreading into an adjacent area.
- To ensure that sites and areas important to Adnyamathanha culture and non-Aboriginal heritage are protected from the threat of bushfire.
- To optimise the protection of significant built assets within and immediately adjacent reserves, including the Wilpena Pound Resort Complex and associated ‘contract for services’ area, Old Wilpena Station, Wilpena power station, and worksites at Oraparinna and Virkundhunha (Balcanoona).
- To reduce the impact of bushfire on community function by providing for the protection of significant community and recreational values and assets within and adjacent to the reserves.
- To maintain or improve biodiversity in reserves by:
 - reducing the likelihood of contiguous remnants of significant bushland burning in their entirety during a single fire event
 - reducing the likelihood of fire threatening species of conservation significance as a result of entire populations (or their habitats) being burnt in a single fire event
 - encouraging variability within the fire regime across the landscape to create a mosaic in habitats that benefit a range of populations and ecosystems
 - reducing the likelihood of fire suppression operations impacting upon the viability of species, populations, and ecological communities.
- To establish and maintain an appropriate level of preparedness (including employee and community equipment and resources) that will enable rapid and effective response for fire management by:
 - preparing Response Plans that consider bushfire risk, including prevailing weather, topography, overall fuel hazard, available resources, and fire location
 - assessing each bushfire and determining strategies promptly
 - maintaining a safe working environment during fire operations, in compliance with the *Work Health and Safety Act 2012 (SA)* and consistent with DEWNR Policy
 - using the functions, roles, and responsibilities of the Australasian Interagency Incident Management System.
- To work with the Co-management Boards, South Australian Arid Lands Natural Resources Management Board, Natural Resources Management Groups, universities, or other research institutions to develop management and research programs that inform DEWNR fire management where appropriate.
- To minimise the likelihood of bushfire significantly impacting on revegetation and reintroduced species representing a considerable capital outlay and/or cultural significance.

1 SCOPE AND PURPOSE

- To improve knowledge of how native species, populations, and ecological communities and habitats respond to fire, and contributing new information and concepts to future management actions.

2 THE PLANNING FRAMEWORK

2.1 Legislation

Fire management planning for public land is influenced by several pieces of state and federal legislation (Table 1). Of most relevance, the FES Act identifies the responsibilities for the South Australian Country Fire Service (CFS) and land management agencies to minimise the risks and impacts of bushfires. Fire Management Plans themselves are not statutory documents but provide the mechanism to meet the statutory requirements under the relevant legislation.

TABLE 1 – LEGISLATION INFLUENCING FIRE MANAGEMENT PLANNING

Legislation	Section	Relevance to fire management
<i>Fire and Emergency Services Act 2005 (SA)</i>	105H-1	Conveys the fire management responsibilities of DEWNR through requirements to minimise the risk of fire threatening life and property, and to reduce the likelihood of fire ignitions and fire spreading through the land that they manage.
	97-6	States that when responding to an incident within a government reserve, CFS should consider the provisions of a management plan and make reasonable attempts to consult with the relevant land manager.
<i>Fire and Emergency Services Regulations 2005 (SA)</i>	36(a)	Provides conditions for lighting of fire by an Aboriginal person during the fire danger season, provided fires are lighted on land set aside for Aboriginal purposes, and used for ordinary domestic purposes within the traditional Aboriginal way of life.
<i>National Parks and Wildlife Act 1972 (SA)</i>	37	Defines overarching management objectives for proclaimed reserves managed by DEWNR or a Co-management Board, which includes the prevention and suppression of bushfires, and provides protection for listed terrestrial flora and fauna.
	38	The Minister for Sustainability, Environment and Conservation (MSEC) must develop a management plan as soon as practicable after the making of a co-management agreement for a reserve. Fire may be an issue addressed in the plan.
	43F	Provides that a co-management agreement may be entered into by the MSEC, on behalf of the State, and sets the terms for the agreement, and provides a provision to establish a Co-management Board, along with giving responsibilities to the relevant Aboriginal group for management of the reserve, including that of fire.
<i>Crown Land Management Act 2009 (SA)</i>	9c	Assigns DEWNR, through the MSEC, with responsibilities for the on-ground management of unalienated Crown land and any Crown land dedicated to, owned by, or under the care and control of the Minister.
<i>Native Vegetation Act 1991 (SA)</i>	29	DEWNR must meet the provisions of the Act if intending to modify native vegetation on its land (this includes burning). Clearance applications are assessed by Native Vegetation Council in accordance with Schedule 1 of the Act.
	23	Outlines the provisions for the establishment of Heritage Agreements for conservation purposes on private land.
<i>Native Vegetation Regulations 2003 (SA)</i>	5A-1	Clarifies which actions can be undertaken to modify native vegetation without approval from the Native Vegetation Council. This includes fuel reduction: for asset protection, on DEWNR reserves or during bushfire emergencies, when establishing or maintaining fire access tracks or fuel breaks for fire control or if required by bushfire prevention plans.

Legislation	Section	Relevance to fire management
	5(1)(zi)	Where clearance is to preserve or enhance ecological processes (e.g. prescribed burning for ecological reasons), a management plan needs to be approved by the Native Vegetation Council, as per the <i>Guidelines for Ecological Prescribed Burning</i> (Native Vegetation Council 2014). Clearance of native vegetation for Aboriginal cultural use needs to consider the Native Vegetation Council Guideline <i>Clearance of native vegetation through Aboriginal cultural resource use activities</i> (Native Vegetation Council 2015).
Aboriginal Heritage Act 1988 (SA)	37	The Act exists to protect and preserve Aboriginal sites, objects and remains. The Act is currently under review. A Register of sites and objects is maintained by the Aboriginal Affairs and Reconciliation Division of the Department of Premier and Cabinet. Section 37 preserves the right for Aboriginal people to act according to tradition. It states that, "nothing in this Act prevents Aboriginal people from doing anything in relation to Aboriginal sites, objects or remains".
Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)	18	Regulation of actions likely to impact nationally-listed species and ecological communities.
	146, 146A and 146B	Outlines the requirement for a strategic assessment to be undertaken. Strategic assessments are landscape-scale assessments and consider a broad set of actions. Where Matters of National Environmental Significance are involved, DEWNR must adhere to the <i>Fire Management Environmental Assessment and Management Procedure</i> (DEWNR 2015a) to meet EPBC Act requirements.
	269AA	Describes when Recovery Plans should be prepared for nationally-listed species and ecological communities (see Section 3.6.4).
Native Title Act 1993 (Cwlth)	211	Allows a native title holder to undertake particular activities for the purpose of satisfying their personal, domestic or non-commercial communal needs and/or in exercise or enjoyment of their native title rights and interests. This legislation allows the creation of Indigenous Land Use Agreements (ILUA), a voluntary binding agreement between a native title group and others about the use of land and waters.

2.2 DEWNR Fire Management Policy

The DEWNR Fire Management Policy (DEWNR 2015b) outlines the agency's fire management responsibilities to protect life, property, culture, and the environment. The Policy states that DEWNR Fire Management Plans will:

- identify fire related risks to natural and cultural heritage and built assets
- define objectives for fire management in the planning area
- identify strategies to achieve these objectives.

DEWNR Fire Management Plans are developed in accordance with DEWNR's procedures for fire management planning, project management, risk assessment, and zoning (DEWNR 2015b).

2.3 Other Influences and Considerations

2.3.1 Land management

The management of Vulkathunha—Gammon Ranges and Ikara—Flinders Ranges NP are the responsibility of Co-management Boards under Division 6A of the National Parks and Wildlife Act 1972 (NPW Act); a formal partnership called a Co-management Agreement, between the Adnyamathanha Traditional Lands Association and the South Australian Government. A Co-management Board (the Board) is responsible for the control and management of reserves designated to that Board. The Board is the relevant authority for the purposes of the National Parks and Wildlife (National Parks) Regulations 2001. The power, role, and function of the Board is set out in the Co-management Agreement, and for those reserves included in this plan, in the National Parks and Wildlife (Vulkathunha—Gammon Ranges National Park) Regulations 2005, and National Parks and Wildlife (Flinders Ranges National Park) Regulations 2011. The Vulkathunha—Gammon Ranges NP Co-management Agreement commenced in 2005. Commencing in 2011, the Ikara—Flinders Ranges NP Co-management Agreement includes an advisory role of the Adnyamathanha community to Ediacara CP (DEWNR 2012b). The Co-management Agreements that apply to reserves in this plan state that the use of fire in the reserves will be subject to the relevant reserve management plan.

An Indigenous Land Use Agreement is a binding agreement under the Native Title Act 1993 (Cwlth) (NT Act) between a native title group and others, in this instance the Adnyamathanha people and the South Australian Government. Negotiations were made to use the reserves included in this plan so that cultural, economic, social, and environmental aspirations can be enhanced in a manner consistent with the management objectives for the reserves (DEH 2006b). The Indigenous Land Use Agreement allows for the use of fire in the exercise of traditional rights to cook and camp, in accordance with the FES Act. However, under the FES Act, cultural use of fire is exempted on days of total fire ban.

Directions for management of the reserves have been developed by the Boards. Reserve management plans are statutory requirements under the NPW Act and may identify the requirement for a Fire Management Plan based on the nature of the fire-related issues within a reserve. Actions implemented in this Fire Management Plan must be consistent with the relevant provisions of the NT Act and be consistent with the South Australian Arid Lands Natural Resources Management (NRM) Plan 2010 (SAAL NRM Board 2010b). In the planning area, reserve management plans have been developed for all reserves.

The reserve management plan for the Ikara—Flinders Ranges NP is currently under review (DEWNR in prep.). The proposed objectives for fire management include supporting Adnyamathanha fire management aspirations, and ecological management; especially for the long-term management of Spinifex habitat to support the Short-tailed Grasswren population, and research into the spread of Vinba. There are two superseded reserve management plans for Ikara—Flinders Ranges NP (DEP 1983, 1989). The fire management objectives from these plans are still relevant today, particularly the need for protection of life and property within the reserve, principally at Wilpena (DEP 1989).

The plan of management for the Vulkathunha—Gammon Ranges NP (DEH 2006b) recommends that a Fire Management Plan be prepared in conjunction with the traditional knowledge of the Adnyamathanha people. Bushfires are not a common occurrence in the region and a low-key ‘watch and wait’ strategy is recommended when no threat is posed to

human life or property. This is particularly emphasised for the Strict Protection zone described in the reserve management plan.

No mention of fire is made in the Ediacara CP Reserve Management Plan (DEWNR 2012b). The main objective of the plan is the preservation of the Ediacaran fossil assemblage. Public access to the reserve is restricted to research groups. Whilst unlikely that fire would spread within Ediacara CP (due to the spatial arrangement of fuels in the reserve), it is highly possible that fire suppression activities could damage the fossils and this should be considered by any fire suppression operation.

The Yellow-footed Rock-wallaby Preservation Association Inc. privately manages Bunkers CR. The *Bunkers Conservation Reserve Management Plan* (Yellow-footed Rock-wallaby Preservation Association Inc. 2012) states that fire mitigation activities should be prioritised to protect human life, infrastructure, Andu (Yellow-footed Rock-wallaby) colonies, and neighbouring properties. The plan prescribes that the protection of Andu habitat be included in any fire suppression plan to safeguard habitat and retain refuge areas, and also that DEWNR will provide guidance in the use of fire as an ecological tool.

This Fire Management Plan will take the objectives of each reserve management plan into consideration, and the risk treatments proposed will minimise the impact of bushfire on public land and be consistent with the current management direction of the Co-management Boards and DEWNR.

2.3.2 Bushfire planning

Fire management planning across South Australia is addressed in Bushfire Management Area Plans (BMAP) prepared by each Bushfire Management Committee (BMC) as a statutory requirement under the FES Act. The planning area for the Northern Flinders Ranges Fire Management Plan is contained within the Outback Bushfire Management Area. An interim BMAP for this area has been developed (Outback Bushfire Management Committee 2012), and a complete BMAP will be developed in time. DEWNR has representation on the Outback BMC, and will contribute to the risk assessments for life, property, and environmental assets within the Outback Bushfire Management Area, and will highlight this DEWNR Fire Management Plan and the risk mitigation strategies included within.

2.4 Partnership Agencies

An agreement exists between the state government public land management agencies (DEWNR, the South Australian Forestry Corporation, and the South Australian Water Corporation) and the CFS to cooperatively manage fire in high fire risk areas. The *Code of Practice for Fire Management on Public Land in South Australia* (DEWNR et al. 2012) aims to improve public safety, reduce the risk to private and community assets, and to reduce the impacts of inappropriate fire regimes on the environment.

Bushfire suppression in rural South Australia is led by the CFS, with DEWNR a CFS group under the FES Act. Responding to a fire in DEWNR reserves is undertaken jointly by DEWNR and other CFS groups. Local CFS brigades are heavily relied upon for fire suppression, particularly in the early stages of an incident. The cooperation and support between CFS groups and brigades, DEWNR, and the local community has been critical to successful fire suppression in the past, and will be critical to achieving the objectives of this plan.

2.5 Consultation

The Co-management Boards and DEWNR are committed to close cooperation and involvement with the Adnyamathanha community, State and Commonwealth Government organisations, special interest groups, and the broader community to achieve the goals of this plan.

Consultation is not a statutory requirement for Fire Management Plans, but is Departmental Policy (DEWNR 2015b). Before this plan was developed, the community were invited to submit their views on fire management in the Northern Flinders Ranges planning area. This was done to ensure that a wide-range of issues were raised early and could be considered within the draft Fire Management Plan.

The draft plan was released for internal consultation for a period of six weeks prior to being released externally for public consultation, for a period of eleven weeks. The plan was then put forward for approval to the Native Vegetation Council's Fire Committee. As the management authorities, the finalised plan was reviewed and adopted by both the Ikara–Flinders Ranges NP and the Vulkathunha–Gammon Ranges NP Co-management Boards, for implementation.

2.6 Plan Review and Currency

This Fire Management Plan will undergo a major review after ten years of implementation, or earlier if required. A works program will be derived from the recommendations listed in this Fire Management Plan and reviewed on an annual basis.

3 BUSHFIRE ENVIRONMENT

This section provides an overview of the planning area, including its location, land use, terrain, vegetation, fire history, weather, and climate. The potential impacts of climate change and conditions conducive to extreme fire intensity and behaviour are also discussed.

3.1 Description of the Planning Area

3.1.1 Location and included lands

The Northern Flinders Ranges planning area covers selected reserves in the central and northern Flinders Ranges and extends from 20 km north of Hawker to east of Lake Torrens and west of Lake Frome (Figure 1). It incorporates approximately 238,000 hectares of reserves (Table 2) and 1,700 hectares of other lands in 18 parcels (Table 3). Other lands includes participating Heritage Agreements, and Crown land managed by DEWNR, including some roadside vegetation. The lands covered by this plan are divided into Fire Management Blocks (discussed further in section 4.1.1), with management strategies for each block discussed in Appendix 1.

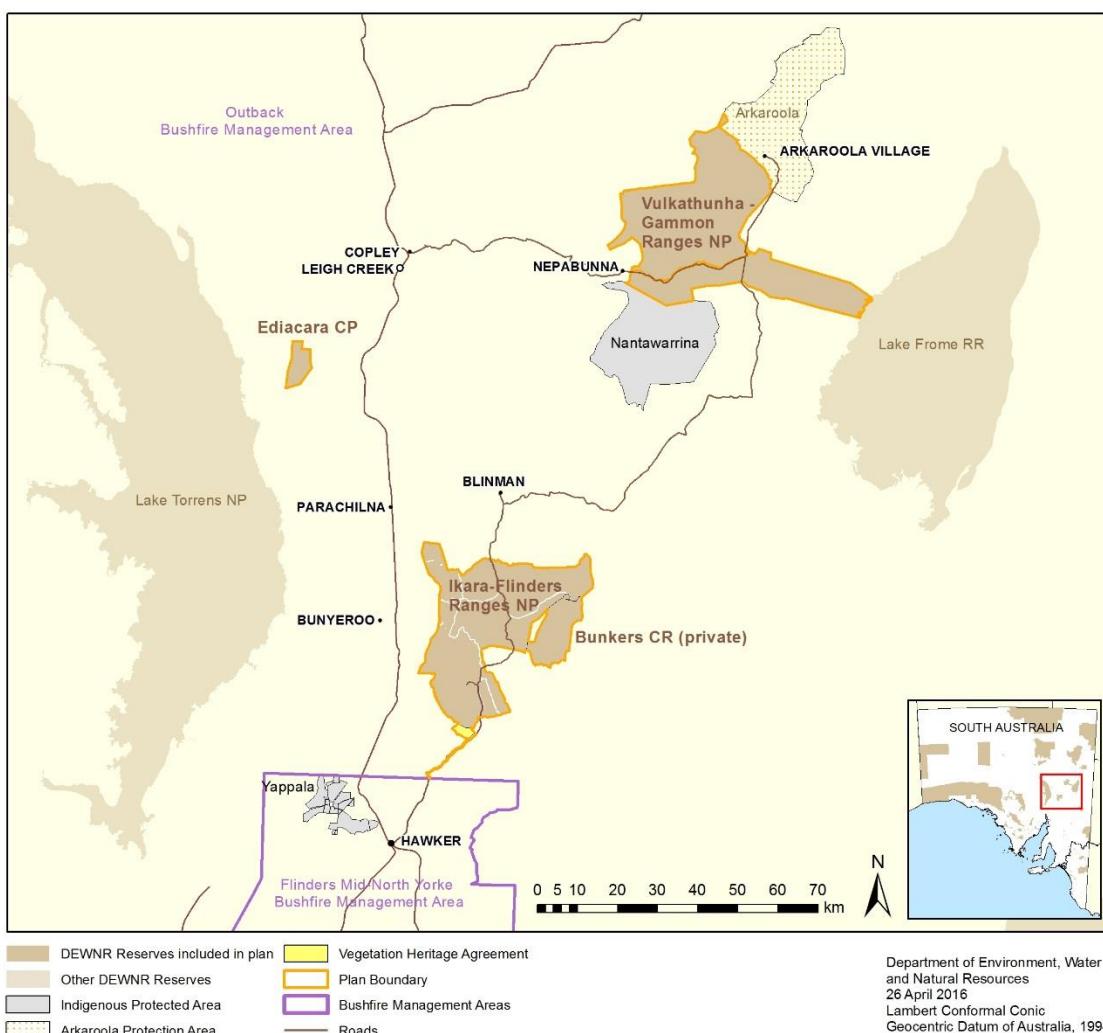


FIGURE 1 – NORTHERN FLINDERS RANGES PLANNING AREA

TABLE 2 – RESERVES INCLUDED IN THIS FIRE MANAGEMENT PLAN

Reserve type	Reserve name	Area (ha)
Conservation Park	Ediacara	4,764
Co-managed National Park	Ikara—Flinders Ranges	93,384
	Vulkathunha—Gammon Ranges	125,723
Private Conservation Reserve	Bunkers	14,062

Proposed reserve additions have been included into this plan to ensure issues are identified and strategies for bushfire risk minimisation are established prior to constitution. Heritage Agreements abutting Co-managed reserves and other included lands have been considered during the planning process; however, it is the responsibility of the individual owner to approve the adoption of this Fire Management Plan for their land and undertake the proposed works (see Section 8).

Crown land dedicated to, owned by, or under the control of the Minister for Sustainability, Environment and Conservation was identified for inclusion into this plan through a risk assessment process considering existing and potential issues for fire management. The proximity to built assets, presence of fire prone native vegetation, location, and size of the parcel was also considered.

TABLE 3 – OTHER LANDS INCLUDED IN THIS FIRE MANAGEMENT PLAN

Tenure	Custodian	Title Reference	Hundred	Section	Area (ha)
Unalienated Crown land	Minister for Sustainability, Environment and Conservation	CR 5762/850	Moralana	19, 20, 21, 22, 23 and 30	401
		CR 5762/853			
		CR 5762/861			
		CR 5762/865	Warcowie	39 and 40	157
		CR 5762/866			
		CR 5776/83	Bunyeroo	190 and 191	0.3
		CR 5762/903			
		CR 5762/903	Edeowie	164	0.2
		CR 5762/942	Parachilna	122	0.1
		CR 5776/83	Out of Hundreds (Parachilna)	1527 and 1528	0.6
		CR 5762/903			
Heritage Agreement	Freehold	CT 6030/457 HA 10416308 (1353)	Moralana and Warcowie	Portion of 10	1,148

3.1.2 Surrounding Land Use

The planning area is located within the country of the Adnyamathanha community. Nantawarra Indigenous Protected Area (IPA), proclaimed in 1998, was Australia's first IPA and adjoins the southern boundary of Vulkathunha—Gammon Ranges NP. IPAs are nationally

recognised as protected areas, and promote biodiversity and cultural resource conservation (Department of the Environment 2013).

Arkaroola Protection Area adjoins the northern boundary of Vulkathunha–Gammon Ranges NP, and is a 60,000 ha private protection area (Worboys & Hore 2013). A reserve management plan is currently in preparation by DEWNR, in consultation with the pastoral leaseholders, the Adnyamathanha native title holders, and the community. Arkaroola was proclaimed in 2012 to protect geological features of international significance (DEWNR in prep.), contains many sites significant to Adnyamathanha culture, and has nationally significant biodiversity conservation values. Arkaroola is also home to populations of Yellow-footed Rock-wallaby colonies, and due to its location adjacent Vulkathunha–Gammon Ranges NP, is extremely important for their long-term conservation.

The remaining land tenure adjoining the reserves is predominantly Adnyamathanha and privately owned pastoral lease with some areas of Crown land. The Willow Springs and Rawnsley Park stations are both adjoining the Ikara–Flinders Ranges NP, and have significant levels of tourism (DEH 2006b). The main land use of the surrounding properties is for pastoral grazing, but the area also has a history of exploration and mining (DEH 2009b).

The Terrain, Tenure and Infrastructure map (map 1; [online](#)) provides an overview of surrounding land tenure.

3.1.3 Terrain

The terrain of the planning area is varied and at times rugged and impenetrable; from the relatively flat landscape of Chenopod shrubland covering most of Ediacara CP (DEWNR 2012b), to the rough terrain of alternating soft and hard sedimentary rocks of the Vulkathunha–Gammon Ranges NP (DEH 2006b). Ikara–Flinders Ranges NP and the Bunkers CR contain aspects of both landscapes; wide plains with sparse vegetation and rocky outcrops, and steep ridges covered by dense vegetation (Brandle 2001).

The rugged landscapes of Vulkathunha–Gammon Ranges NP and Ikara–Flinders Ranges NP prove the most difficult for fire management. Tracks are often one way in areas of steep terrain and many blind crests and steep drops further add to the risks for firefighting.

3.1.4 Climate and Fire Weather

The climate of the Northern Flinders Ranges is continental and arid, with the exception of the highest peaks that create islands of higher rainfall (DEH 2006b). Rainfall quantity reduces along the northern fringes of the ranges, in the western rain-shadow the ranges create and on the plains of the north (Brandle 2001). The majority of rainfall in the central Flinders Ranges, such as around Ikara–Flinders Ranges NP occurs during the months of winter with some significant summer events (Flinders Ranges Visitor Information Centre 2012), whereas rainfall in the northern Flinders Ranges is mainly in late spring and summer (DEH 2006b). Mean annual rainfall varies from 256.9 mm in the northern Flinders (BOM 2013) to 308.4 mm in the central Flinders (BOM 2012). The sporadic and often heavy nature of precipitation can cause flash flooding and severe erosion.

Temperatures in summer are fairly uniform across the planning area with hot clear skies. The mean temperate is 34.2°C with the mean minimum reaching no cooler than 18°C overnight. The coldest month of July can experience frosty nights and temperatures usually reach from 16°C during the day, down to 3°C overnight (BOM 2012, 2013). Light snow will occasionally fall on the tallest peaks (Flinders Ranges Visitor Information Centre 2012).

Summer winds are mainly from the north and create hot and drying conditions that increase the risks for firefighting. Winter winds are most frequently from the east (BOM 2013). Topography can have a marked effect on local wind speed and direction. Valleys, for example, can channel the winds and cause local wind anomalies (Crawford 2013, pers. comm.).

3.2 Climate Change and Bushfire

The Australian climate has shown to be changing (CSIRO & Bureau of Meteorology 2014), and that trend is mirrored in South Australia (DENR 2010b; Suppiah et al. 2006). Warmer and longer fire danger seasons are likely (CSIRO & Bureau of Meteorology 2014), with reduced opportunities to undertake fuel management prescribed burns (Hennessy et al. 2005). However, the specific ways that climate change will impact all aspects of fire management are unknown: fuel accumulation rates, plant decomposition rates, fuel moisture, humidity and particularly rainfall patterns are either unknown or likely to be impacted in a complex manner, making accurate predictions difficult on a local scale (Enright & Fontaine 2014).

Climate change projections indicate that the Northern Flinders Ranges planning area is likely to become hotter and drier in future (DENR 2010a; Suppiah et al. 2006); annual temperatures are predicted to increase by up to 1.5°C, and for rainfall to reduce as much as nine per cent by 2030 (Suppiah et al. 2006), with a greater summer component and rainfall variability to continue (Bastin 2014). Summers are likely to be warmer and perhaps wetter (but summer rainfall has shown difficult to predict, and any increases in rainfall may be offset by increased rates of evaporation); autumns, winters and springs are likely to be warmer and drier (Suppiah et al. 2006).

In arid and semi-arid regions dominated by grass fuel systems fire generally follows peak rainfall events, which is the reverse situation to that observed where woody fuels dominate, and fire generally follows drought (Williams et al. 2009). Recent research modelling the interaction of predicted climate change, fire regimes and biodiversity in Australia to 2070 suggests that in arid woodlands, fire danger is likely to increase (Williams et al. 2009). However, a concurrent significant decline in rainfall may lead to a decrease in area burned and fire frequency in herbaceous ecosystems (Williams et al. 2009). The impact of Buffel Grass is predicted to be significant, due its high drought tolerance, which is likely to provide "levels of biomass and spatial connectivity that may exceed that contributed by native grasses and herbage" (Williams et al. 2009), and potentially support more frequent and high intensity fires.

The limiting factor for incidence and intensity of fire in the Northern Flinders Ranges planning area is fuel production that is likely to be reduced by projected climate change (Brandle 2013b). Projected climate change will also influence fuel moisture content resulting in drier fuels. This may mean that whilst fire incidence reduces due to less fuel, fire intensity may increase relative to fuel moisture. However, continuing rainfall variability will likely mean that fuel accumulation sufficient to carry extensive bushfire will likely continue to require two (or more) years of above-average rainfall (Bastin 2014). Increased warming with associated lower humidity combined with continuing rainfall variability should present more frequent opportunities to use managed fire to control woody thickening (invasive native scrub) in pastoral country in the Flinders Ranges (Bastin 2014).

While land managers may grapple with the uncertainty of the climate predictions, adaptive management principles remain the most logical strategy for fire management programs. Expanding our options for dealing with climate change will be critical to delivering effective

responses in the future. This preparedness is especially important given that the precise timing and magnitude of climate change impacts are uncertain (DEWNR 2012d).

3.3 Extreme Fire Conditions

Strong winds combined with high temperatures and low humidity increases the likelihood of extreme fire intensity and behaviour. Under such conditions, suppression activities are unlikely to be effective. Fires will be unpredictable and fast moving and will produce embers with spot fires likely to occur some distance ahead of the fire front. People in the path of the fire will be at significant risk.

Buildings constructed to the requirements of *Australian Standard for Construction of Buildings in Bushfire-prone Areas AS3959-2009* will not necessarily survive a bushfire event on every occasion, but are intended to reduce the risk to occupants (Eadie & Herbert 2009).

The following factors will contribute to a dramatic increase in fire behaviour.

- *High* and above Fire Danger Indices
- *Very High* to *Extreme* overall fuel hazard levels
- Broad areas of continuous *Very High* to *Extreme* fuel hazard levels, making fire suppression less effective
- Low humidity, decreased soil and fuel moisture, particularly during drought years
- Strong winds shifting direction during the course of a fire, typically north-west to south-west
- Lightning strikes as a result of increased thunderstorm activity during the summer months
- Steep terrain
- Peak or significant rainfall events leading to the recruitment of dense perennial and annual grasses.

3.4 Fire History

3.4.1 Mapping Fire Occurrences

The Fire History map (map 3; [online](#)) has been compiled from DEWNR fire incident reports for the past ten years. The quality of this mapping varies, depending on the method of capture. Only visible burn areas over 0.5 hectares (ha) in size have been mapped and mapping is generally limited to fires that have occurred on DEWNR or Co-managed lands, or fires where DEWNR was in attendance. Consequently, the mapped fires should be regarded as a minimum estimate of fire occurrences.

3.4.2 Bushfires

Detailed records of recent fire incidents that have occurred on DEWNR or Co-managed lands are stored within the Department's Fire Information Management System. This database, along with spatial and any other historical records, was reviewed during the development of this Fire Management Plan. Of those bushfires recorded, lightning strike is the most common cause of ignition (DEP 1989). Since 1972 a total of 21 bushfire incidents have been recorded on or close to reserves in the planning area. Ikara—Flinders Ranges NP contains the highest number of recorded fires. The larger incidents for the planning area include the following:

- 2015: summer bushfire starting from lightning strike. Burnt 4,329 ha in the Vulkathunha—Gammon Ranges NP

- 2014: spring bushfire starting from lightning strike. Burnt 46 ha near Willow Springs
- 2012: summer bushfire starting from lightning strike on Point Bonney, Ikara. Burnt 814 ha in the Ikara—Flinders Ranges NP (including 200 ha of back burn)
- 2007: summer bushfire burnt 522 ha in the area of Mount McKinlay, Vulkathunha—Gammon Ranges NP
- 1996: summer bushfire burnt 405 ha across five locations of the centre of Ikara—Flinders Ranges NP. The largest fire burnt near Appealinna Ruin
- 1988: summer bushfire burnt 11,187 ha, which burnt most of Ikara in the Ikara—Flinders Ranges NP.
- 1988: autumn bushfire burnt 309 ha at Rawnsley Park Station
- 1979: bushfire burnt 1,137 ha in the Ikara—Flinders Ranges NP
- 1972: spring bushfire burnt 293 ha entering the Ikara—Flinders Ranges NP from private land along the western boundary and moving to the north-west of Malloga Falls.

There is also anecdotal evidence of additional unmapped fires with ignition causes including lightning and arson.

3.4.3 Prescribed Burning

Prescribed burning has not previously been undertaken within the reserves included in this Fire Management Plan.

Prescribed burning may be carried out in the plan area to achieve fire management objectives within Asset Protection, Bushfire Buffer and Conservation-Land Management zones. Fuel reduction in Asset Protection and Bushfire Buffer zones, and Conservation-Land Management-zone burning is discussed in Section 5.3.3.

3.5 Vegetation Communities

Floristic mapping for this plan uses a compilation of regional vegetation mapping data that have been reclassified to comply with the National Vegetation Information System (NVIS) classification for Australia (Executive Steering Committee for Australian Vegetation Information 2003). The Major Vegetation Sub-group (MVS) level of the NVIS classification emphasises the structural and floristic composition of the dominant stratum but with additional types identified according to typical shrub or ground layers occurring with a dominant tree or shrub stratum. Within this Fire Management Plan MVS have been used as these groupings are accepted by fire managers for predicting maximum overall fuel hazard levels (see Section 4.2.2).

There are 17 MVS within the planning area that have been mapped by DEWNR. The Vegetation Communities map (map 2; [online](#)) shows the distribution of MVS in the planning area.

Table 4 (below) lists the species composition for each MVS.

TABLE 4 – DOMINANT SPECIES LAYERS FOR MAJOR VEGETATION SUB-GROUPS

MVS No.	MVS Name	Dominant Species Layers
8	Eucalyptus woodlands with a shrubby understorey	<i>Eucalyptus camaldulensis</i> var., +/- <i>Callitris glaucophylla</i> mid woodland over <i>Melaleuca glomerata</i> , +/- <i>Acacia salicina</i> tall open shrubland over <i>Acacia victoriae</i> ssp. over <i>Maireana pyramidata</i> , <i>Enchytraea tomentosa</i> var., <i>Cymbopogon ambiguus</i> , <i>Malvastrum americanum</i> .
12	Callitris forests and woodlands	<i>Callitris glaucophylla</i> low woodland over <i>Austrostipa scabra</i> ssp., <i>Austrodanthonia caespitosa</i> , <i>Triodia</i> sp., <i>Senecio magnificus</i> , +/- <i>Leiocarpa semicalva</i> ssp. low open tussock grassland.
20	Mulga (Acacia aneura) woodlands and tall shrublands with tussock grass	<i>Acacia aneura</i> var., +/- <i>Alectryon oleifolius</i> ssp. <i>canescens</i> low open woodland over <i>Tetragonia eremaea</i> , <i>Brassica tournefortii</i> , <i>Rhodanthe moschata</i> , <i>Schismus barbatus</i> , +/- <i>Sclerolaena obliquicuspis</i> low open formland.
21	Other acacia tall open shrublands and shrublands	Emergent <i>Casuarina pauper</i> low open woodland over <i>Acacia ligulata</i> , <i>Dodonaea viscosa</i> ssp. <i>angustissima</i> mid open shrubland over <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Zygochloa paradoxa</i> low sparse shrubland over <i>Atriplex velutinella</i> .
22	Arid and semi-arid acacia low open woodlands and shrublands with chenopods	<i>Acacia aneura</i> complex, +/- <i>Alectryon oleifolius</i> ssp. <i>canescens</i> low open woodland over <i>Acacia victoriae</i> ssp., <i>Acacia tetragonophylla</i> tall sparse shrubland over <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , <i>Eremophila freelingii</i> , +/- <i>Dodonaea microzyga</i> var. <i>microzyga</i> . Also, <i>Acacia victoriae</i> ssp., +/- <i>Eremophila duttonii</i> , +/- <i>Alectryon oleifolius</i> ssp. <i>canescens</i> , +/- <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Acacia tetragonophylla</i> tall open shrubland over <i>Rhagodia spinescens</i> , <i>Maireana pyramidata</i> , +/- <i>Maireana aphylla</i> low open shrub. Also, <i>Acacia victoriae</i> ssp., <i>Acacia tetragonophylla</i> , +/- <i>Acacia oswaldii</i> , +/- <i>Acacia rivalis</i> tall open shrubland over <i>Senna artemisioides</i> ssp., <i>Eremophila freelingii</i> , <i>Dodonaea lobulata</i> over <i>Sida petrophila</i> , <i>Ptilotus obovatus</i> var. low open shrubland over <i>Cymbopogon ambiguus</i> .
24	Arid and semi-arid acacia low open woodlands and shrublands with tussock grass	<i>Casuarina pauper</i> , +/- <i>Alectryon oleifolius</i> ssp. <i>canescens</i> low open woodland over <i>Senna artemisioides</i> ssp. <i>coriacea</i> , <i>Senna artemisioides</i> ssp. <i>petiolaris</i> (NC), <i>Senna artemisioides</i> ssp. <i>filifolia</i> mid open shrubland over <i>Maireana sedifolia</i> , <i>Enchytraea tomentosa</i> . Also, <i>Allocasuarina verticillata</i> , +/- <i>Allocasuarina muelleriana</i> ssp. low woodland over <i>Lepidosperma</i> sp. low sparse sedgeland.
26	Casuarina and Allocasuarina forests and woodlands	<i>Casuarina pauper</i> , <i>Alectryon oleifolius</i> ssp. <i>canescens</i> , <i>Senna artemisioides</i> ssp. <i>coriacea</i> , <i>S. artemisioides</i> ssp. <i>filifolia</i> , <i>Maireana sedifolia</i> , and <i>Enchytraea tomentosa</i> .
27	Mallee with hummock grass	<i>Eucalyptus gillii</i> , +/- <i>Eucalyptus socialis</i> ssp. mid open mallee woodland over <i>Acacia tetragonophylla</i> , <i>Acacia rivalis</i> , <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Acacia araneosa</i> tall sparse shrubland over <i>Triodia</i> sp., <i>Ptilotus obovatus</i> var., <i>Maireana pentatropis</i> . Also, <i>Eucalyptus flindersii</i> , +/- <i>Callitris glaucophylla</i> mid mallee woodland over <i>Melaleuca uncinata</i> (NC), <i>Acacia havilandiorum</i> , <i>Xanthorrhoea quadrangulata</i> , +/- <i>Allocasuarina muelleriana</i> ssp., +/- <i>Calytrix tetragona</i> mid shrubland over <i>Triodia</i> sp., <i>Lomandra multiflora</i> .

MVS No.	MVS Name	Dominant Species Layers
29	Mallee heath and shrublands	<i>Eucalyptus socialis</i> ssp., +/- <i>Eucalyptus gracilis</i> , +/- <i>Eucalyptus dumosa</i> mid mallee woodland over <i>Eremophila scoparia</i> , <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , +/- <i>Eremophila glabra</i> ssp. <i>glabra</i> mid sparse shrubland over <i>Olearia muelleri</i> , <i>Maireana pentatropis</i> .
31	Chenopod shrublands	<i>Nitraria billardierei</i> , +/- <i>Maireana pyramidata</i> low open shrubland over <i>Sclerolaena obliquicuspis</i> , <i>Carrichtera annua</i> , <i>Tetragonia eremaea/tetragonoides</i> . Also, <i>Atriplex vesicaria</i> ssp., <i>Maireana astrotricha</i> , <i>Maireana pyramidata</i> , +/- <i>Maireana sedifolia</i> , +/- <i>Ptilotus obovatus</i> var. <i>obovatus</i> low shrubland over <i>Zygophyllum aurantiacum</i> ssp., <i>Sclerolaena obliquicuspis</i> , +/- <i>Solanum ellipticum/quadriloculatum</i> . Also, <i>Maireana aphylla</i> , <i>Maireana pyramidata</i> low sparse shrubland over <i>Sclerolaena brachyptera</i> , <i>Sclerolaena ventricosa</i> , <i>Sclerolaena divaricata</i> , <i>Eragrostis setifolia</i> .
32	Other shrublands	<i>Eremophila sturtii</i> , <i>Eremophila duttonii</i> , +/- <i>Acacia victoriae</i> ssp. tall open shrubland over <i>Rhagodia spinescens</i> , <i>Maireana pyramidata</i> , <i>Dodonaea microzyga</i> var. <i>microzyga</i> low sparse shrubland over <i>Sclerolaena obliqui</i> .
33	Arid and semi-arid hummock grasslands	<i>Triodia irritans</i> complex, <i>Cymbopogon ambiguus</i> , <i>Austrostipa nitida</i> low hummock grassland.
34	Mitchell grass (<i>Astrebla</i>) tussock grasslands	<i>Astrebla pectinata</i> low open tussock grassland over <i>Sclerolaena divaricata</i> , <i>Sclerolaena longicuspis</i> , <i>Enneapogon avenaceus</i> , <i>Leiocarpa websteri</i> .
37	Other tussock grasslands	<i>Cymbopogon ambiguus</i> , <i>Austrostipa nitida</i> , <i>Enneapogon</i> sp., <i>Aristida</i> sp., +/- <i>Asphodelus fistulosus</i> low open tussock grassland. Also, <i>Sclerolaena brachyptera</i> , <i>Enneapogon avenaceus</i> , <i>Sporobolus actinocladus</i> , <i>Astrebla pectinata</i> , <i>Sclerolaena divaricata</i> low open tussock grassland.
39	Mixed chenopod, samphire or forblands	<i>Sclerolaena divaricata</i> , <i>Tetragonia eremaea</i> , <i>Plantago drummondii</i> , <i>Calotis hispidula</i> , <i>Dissocarpus paradoxus</i> low sparse shrubland. Also, <i>Tecticornia indica</i> ssp., <i>Tecticornia pergranulata</i> ssp., <i>Atriplex holocarpa</i> low open shrubland.
47	Eucalyptus open woodlands with shrubby understorey	<i>Eucalyptus intertexta</i> , +/- <i>Callitris glaucophylla</i> low open woodland over <i>Dodonaea viscosa</i> ssp., <i>Senna artemisioides</i> ssp. <i>petiolaris</i> , <i>Cassinia laevis</i> , +/- <i>Acacia rivalis</i> , <i>Dodonaea lobulata</i> mid open shrubland over <i>Ptilotus obovatus</i> var. <i>obovatus</i> , <i>Olearia decurrens</i> .
55	Mallee with an open shrubby understorey	<i>Eucalyptus porosa</i> , +/- <i>Eucalyptus odorata</i> , +/- <i>Callitris glaucophylla</i> mid open mallee forest over <i>Cassinia laevis</i> , <i>Olearia decurrens</i> mid sparse shrubland over <i>Enchytraea tomentosa</i> var., <i>Rhagodia parabolica</i> , <i>Triodia irritans</i> complex, <i>Austrostipa</i> sp. low open tussock grassland.

3.6 Values and Assets

3.6.1 Visitor Use

The reserves of the Northern Flinders Ranges receive a significant number of visitors per year. The Flinders Ranges has been recognised as an important tourism asset and is part of the National Landscapes Program, which recognises tourism landscapes of national significance (DEWNR 2012c). Approximately 100,000 people visited the Ikara—Flinders Ranges NP in 2000–2001 (DEH 2001) with most people visiting from autumn to spring, avoiding the hot summers (DEH 2006b). An estimated 17,000 people visit Vulkathunha—Gammon Ranges NP annually; of these, the majority are from overseas and stay overnight in the park (DEH 2002b). General

public access is not granted to Ediacara CP, Bunkers CR, Heritage Agreements, or Crown land.

Adventure-based activities such as bushwalking, four-wheel driving and camping are the most popular activities that visitors undertake within the Northern Flinders Ranges (DEH 2002b). The routes for the Heysen (walking) and Mawson (bike riding) trails go through the Ikara—Flinders Ranges NP. The Heysen trail is closed across private land during the fire danger season (DEH 2007).

Within Ikara—Flinders Ranges NP, the Wilpena Pound Resort provides accommodation for visitors, with 60 motel style rooms, a campground, restaurant facilities, and visitor's centre, all operated by a lessee. Accommodation for staff is also found on site. Outside of Wilpena, bush camping is offered in designated sites at various locations throughout the park (DEH 2001).

Vulkathunha—Gammon Ranges NP has a small DEWNR staff population at Vulkathunha (Balcanoona). Shearers quarters-style accommodation and small huts are available for rent and are well patronised. Bush campsites are also present within the park. Most of the park still remains accessible by foot only, attracting self-sufficient bushwalkers (DEH 2006b). This carries a significant challenge for fire management as the means to communicate with visitors of the risk or presence of a fire is difficult.

Management Strategies

Visitor Use

1. Campsites and other relevant areas to be closed on days of heightened fire danger as per DEWNR park closure policy.
2. Wilpena Pound Resort, in conjunction with the CFS, to prepare a Bushfire Survival Plan for visitor facilities as required and review annually.
3. Implement appropriate fuel management strategies for asset protection and visitor safety (refer to Fire Management and Access map (map 4; [online](#))).
4. DEWNR to provide appropriate bushfire education and information to visitors.

3.6.2 Built Assets

There are substantial built assets at risk from bushfire within the reserves and these have been considered as part of the risk assessment. Ikara—Flinders Ranges NP has many, including:

- Wilpena resort; consisting of a visitor information centre, shop, restaurant, accommodation, camping facilities, and swimming pool
- Wilpena staff accommodation
- sheds and fuel stores at Wilpena and Oraparrina airstrips
- the Old Wilpena Station heritage precinct assets, and Hills hut, Guide hut, and Pumpas hut
- solar panel power station at Wilpena
- Wilpena Spring; the main source of water for Wilpena, and various bores and tanks
- Oraparinna worksite; consisting of workshop, staff office and accommodation, shearers quarters and sheds, water supply, remote area power system, explosives and fuel stores, and Prices bore

- other various major infrastructure throughout the park, such as campgrounds, toilets, walking trails, huts, and day visitor areas
- Appealinna heritage site stone buildings and miner's dugout
- Perawurtina cultural site (petroglyphs) and Arkaroo Rock ochre art work
- radio and telecommunications towers
- minor infrastructure consisting of fences, stockyards, signs, trail markers, and lookouts.

Vulkathunha—Gammon Ranges NP has the following built assets within the park:

- the Virkundhunha (Balcanoona) precinct, including old homestead, shearing shed and shearers quarters, meathouse, machine shop, sheep-yards, and stone water tanks
- Balcanoona airstrip, used by the Royal Flying Doctor Service and Arkaroola Air Services
- Grindell's hut visitor accommodation with original shepherds hut, stone residence, and stone water tanks
- Oocaboolina outstation with residence, shed, stone tanks, and sheep yards
- Nudlamutana hut visitor accommodation and well, with residence, yards, windmill, and stone tank
- Idnina stone and iron house, crutching shed, yards, stone tank, and windmill
- Illinawortina stone ruins, which represent a total pastoral complex of that era
- radio and telecommunications towers
- Moomba gas pipeline
- Bolla Bollina smelter historic site
- section of the dingo fence
- remote area power system
- minor infrastructure of fences, signs, trail markers, information bays, campgrounds, and walking trails.

Ediacara CP contains minor built infrastructure consisting of fences, signs, trail markers, smelter sites, ruins, and gantry.

Bunkers CR has the following built assets within the park:

- Yellow-footed Rock-wallaby Preservation Association Inc. assets consisting of facilities building, campground, bores, pump shed, and storage sheds
- GRN/UHF repeater station and satellite tower
- minor infrastructure of fences, signs, trail markers, bores, and gates.

In addition to these on park assets, there are others nearby that could potentially be threatened by a fire burning on lands included in this Fire Management Plan, including:

- Arkaroola village
- airstrip and hangars adjacent the Illawortina block boundary
- Nepubunna community and Nantawarrina Indigenous Protected Area
- Rawnsley Park Station, with visitor accommodation consisting of camping facilities, cabins and eco-villas, restaurant, residential housing, and office building

- Willow Springs Station, with camping facilities and cabins, along with residential housing
- Warriota homestead
- Oraparinna asbestos mine (open pit)
- Dunbar and Elatina mines
- Flinders Ranges Highway, Blinman Road, Bunyeroo Road, and Brachina Gorge Road (major roads with high usage)
- Grazing land and associated infrastructure such as fences and waterpoints.

DEWNR will undertake fire management works and activities to minimise the likelihood of fire impacting built assets (both public and private assets) if required.

Appendix 1 further details assets within and adjacent to lands included in this Fire Management Plan that have been considered during the risk assessment, and the corresponding fire management strategies. The Terrain, Tenure and Infrastructure map (map 1; [online](#)) shows the location of assets within the planning area.

Management Strategies

Built Assets

5. Implement fuel management strategies for asset protection consistent with the fire management zoning shown on the Fire Management and Access map (map 4; [online](#)) and other risk mitigation works as detailed in Appendix 1.
6. Encourage the Outback Bushfire Management Committee to liaise with property owners to implement appropriate and coordinated fire management works to minimise the threat of bushfire across the landscape.
7. Encourage volunteer participation in undertaking approved fuel reduction activities on public lands, such as weed spraying and removal.
8. Ensure all major built assets are identified in Response Plans.
9. Identify and inform Incident Action Planning / Response Planning of significant hazards within the planning area (including Oraparinna asbestos mine and Oraparinna explosives store).

3.6.3 Cultural Heritage

Information on Aboriginal and non-Aboriginal heritage is collected during prescribed burn planning as part of the Environmental Assessment (EA) (refer to 5.3.5) (DEWNR 2014). Any fire operations must be in accordance with the *Protection of Cultural Heritage Procedure* (DEWNR 2015b).

Adnyamathanha Heritage

The land comprising the Northern Flinders Ranges forms part of the country of the Adnyamathanha people. Native title rights have been granted for Adnyamathanha No. 1 Stage 1, and Adnyamathanha No. 2, giving the Adnyamathanha community rights to the lands within these determinations as applicable to the NT Act. Fire is an important part of Adnyamathanha cultural protocol.

In the Adnyamathanha language Adnya means rock and mathanha means people (DEH 2009d). All lands within the plan, including the water, plants, and animals have many complex and interconnecting meanings and values. The Adnyamathanha people refer to this as Yura Muda, where Yura are the Aboriginal people, and Muda are the diverse creation stories, ceremonies, and law. The land and physical features of the reserves within this plan are a key element of Yura Muda (DEWNR in prep.).

The Awu Urtu (permanent waterholes and springs) and ephemeral streams and waterholes are important aquatic habitats. They provide critical habitat and drought refuge for wildlife, and are a focal point in the ecosystem. They are also important to Yura Muda as they are vital for life in the ranges and have spiritual and cultural significance, being the features of many of the Adnyamathanha creation stories (DEWNR in prep.). For these reasons, it is important that any chemicals used for fire suppression are excluded from waterholes and springs as discussed in Section 6.2.

Adnyamathanha heritage sites have been recorded throughout the Ikara–Flinders Ranges NP and Vulkathunha–Gammon Ranges NP. These reserves contain sites that have been listed on the Central Archive, which includes the Register of Aboriginal Sites and Objects (the Register). It should be noted that the Register is not a comprehensive record of all Aboriginal sites and objects in South Australia, therefore sites or objects may exist in the planning area that the Register does not identify. When implementing this plan, DEWNR will comply with the *Aboriginal Heritage Act 1988* to protect sites during bushfire suppression and prescribed burns.

In 2003 Vulkathunha–Gammon Ranges NP was co-named to include Vulkathunha in its title to recognise Adnyamathanha tradition (DPC 2003). In the language of the Adnyamathanha people this word means *old lady* and reflects a significant Adnyamathanha story connected with the area (DEH 2006b).

Non-Aboriginal Heritage

Non-Aboriginal settlement of the Northern Flinders Ranges began in the 1840s, with Ikara being discovered by European pastoralists around 1850. Sheep and cattle stations were soon established. Crops were also cultivated within Ikara, but this ceased in 1914. Thereafter, use was limited to mainly sheep grazing (Norris 1988).

Evidence of this early history is scattered throughout the Northern Flinders Ranges region, and is found in the form of buildings and other structures. Most buildings were used for agriculture, but historical mining infrastructure is also found. Lead-silver ore deposits were discovered in the late 1880s in the area now covering Ediacara CP. Extraction continued until 1918 and remnants of this activity include abandoned mine shafts and ruins (DEWNR 2012b).

The more recent history of the planning area has included mining, smelting, and sheep grazing (DEH, 2006).

Management Strategies

Cultural Heritage

10. Implement fuel management strategies appropriate for the protection of assets of cultural heritage significance as shown on Fire Management and Access map (map 4; [online](#)).
11. During bushfire response, assign an Adnyamathanha authorised officer or DEWNR Liaison Officer as primary contact to identify significant cultural assets for protection.
12. During bushfire response, consult the cultural sites register to minimise impacts on significant cultural assets.
13. Identify significant natural water sources and catchments for exclusion of fire suppression chemicals to inform the Incident Action Plan / Response Plan.
14. Adnyamathanha authorised officer and Adnyamathanha Traditional Lands Association to be consulted when planning prescribed burns for reserves.
15. Integrate traditional knowledge about fire management with contemporary scientific principles and technology to develop best practice for the region.
16. Prior to a prescribed burn or during a bushfire, and before any earthworks are undertaken, appropriate consultation is undertaken to identify cultural sites. After a fire, evaluate sites to establish if any damage has occurred and include remediation works in post-fire works plans.

3.6.4 Natural Values

The Biological Database of South Australia contains records from several data sources, including the Threatened Plant Population Database, the Biological Survey of South Australia, Adelaide Herbarium, research data sets, and opportunistic sightings of significant flora and fauna. Regular extracts of BirdLife Australia and The Atlas of Living Australia data are incorporated into DEWNR's Environmental Database of South Australia. DEWNR is aware that there are many valuable sources of data, and every effort is made to include these in the database.

Fire response information, where known, is included for species and ecological communities of conservation significance in Appendices 2, 3, and 4.

In this plan, 'of conservation significance' is used to describe rated species of flora, fauna, and ecological communities. These may be:

- nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, or Vulnerable) under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable, or Rare) under the NPW Act, Revised Schedules 7, 8, and 9
- provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished DEWNR Provisional List of Threatened Ecosystems of South Australia (DEH 2005b) and/or the Regional Species Conservation Assessment Project (DEWNR 2013d).

DEWNR is committed to increasing its capacity to incorporate species' requirements into improved ecological fire management. The actions in this plan relate specifically to fire management actions within reserves; nevertheless DEWNR will continue to work with the community on landscape-scale biodiversity conservation.

Flora, Fauna, and Ecological Communities

The following section details those species and ecological communities that are a focus for fire management actions, and have been considered in the risk assessment process.

There are a number of flora and fauna species as well as an ecological community considered to be of conservation significance within the planning area. Appendices 2 and 3 contain lists of flora and fauna of conservation significance as well as species that are considered important in terms of fire management. Note that this is not intended to be an exhaustive list of rated species within the plan area as it excludes rated species that are considered to be functionally extinct or unlikely to be affected by bushfire or fire management activities. Appendices 2 and 3 summarise the current level of fire response knowledge for these species. Appendix 4 summarises information on threatened ecological communities.

In addition to the information provided within the appendices, species response and ecological information for selected significant species and an ecological community have been detailed in the following paragraphs. Selection within this plan is based upon a risk rating of high or above when assessed using the *Risk Management in Fire Management Planning Procedure* (DEWNR 2015b). These include the following rated species:

- Andu (Yellow-footed Rock-wallaby, *Petrogale xanthopus xanthopus*)
- Short-tailed Grasswren (*Amytornis merrotsyi*)
- Brown Toadlet (*Pseudophryne bibroni*)
- Flinders Ranges Purple-spotted Gudgeon (*Mogurnda clivicola*)
- Reintroduced Fauna: Idnya (Western Quoll, *Dasyurus geoffroii*) and Virla (Common Brushtail Possum, *Trichosurus vulpecula*).

Ecological community of conservation significance:

- Spinifex (*Triodia* sp.) Hummock Grassland.

Andu

Andu (*Petrogale xanthopus xanthopus*) is listed as Vulnerable both within South Australia and nationally. An [Ecological Fire Management Strategy](#) has been developed by DEWNR in consultation with the Yellow-footed Rock-wallaby Recovery Team (DENR 2007). This strategy focuses on fire risk management for Andu, identifying issues for consideration before, during, and after fire. A draft Andu Recovery Plan has also been produced by DEWNR (Baker-Gabb 2008).

DEWNR's Bounceback Program is a landscape-scale conservation program that aims to protect and restore the semi-arid environments of the Flinders, Olary, and Gawler Ranges. Bounceback operates on DEWNR-managed reserves, Aboriginal owned and managed lands, private sanctuaries, and pastoral lands. Management actions to recover populations of Andu have been coordinated by DEWNR for more than 20 years. Andu is both a target and key indicator species for the Bounceback Program with numbers increasing from less than 50 in the early 1990s to more than 1,000 in 2009 (DEWNR 2012a).

In the Northern Flinders Ranges, Andu inhabit high mountain ranges and hills. They have suffered a major decline in both distribution and abundance across most of their range (DEH 2009c). Populations can fluctuate by over 50 per cent from one year to the next, with the most severe declines recorded in the smaller disjunct populations during droughts (Baker-Gabb 2008; Sharp 1999).

Altered fire regimes will affect the population size of Andu. Fires can directly result in the mortality of individual Andu due to radiant heat, vurndu (smoke), and flame. Indirect impact can occur by food resources being severely depleted, and increased post-fire competition from herbivores. Fire also results in loss of vegetation cover, exposing any surviving Andu to predators, and may also affect habitat quality due to changes in floristic composition (DEH 2009a). The overall risk to colonies, populations, habitats, and home ranges from bushfires is considered Extreme (DENR 2007). If no action is taken to mitigate the negative effect of bushfire, the impact on Andu could be Major. This is considered an unacceptable risk (DENR 2007). Refer to section 4.1 for a description of DEWNR's risk assessment process.

Management Strategies

Andu

- 17.** Adopt and implement fire management actions as identified in the Ecological Fire Management Strategy to minimise the risk of local extinctions of Andu.
- 18.** Strategic fire access tracks should be maintained in the vicinity of and between local Andu populations to the current Government Agencies Fire Management Working Group standards to provide access for firefighters, and to contain fire.
- 19.** Any prescribed burning conducted near Andu habitat will be planned in conjunction with the Bounceback Program.
- 20.** Where possible, bushfires should be restricted from burning the entire home range of an Andu colony or population.

Short-tailed Grasswren

The Short-tailed Grasswren (*Amytornis merrotsyi*) is a small, ground dwelling bird listed as regionally Rare. The species is endemic to the Flinders Ranges (Garnett, Szabo & Dutson 2011). These birds are found only on rocky hillsides covered in large clumps of Spinifex (*Triodia* spp.) (Garnett & Crowley 2000) and occupy small areas, with fewer than 10 remaining locations (IUCN 2013).

Excessive frequency of fires, both natural and human-initiated, along with grazing, and the encroachment of Vinba (Northern Cypress Pine, *Callitris glauophylla*) on Spinifex have been identified as the most immediate threats to the species (Higgins, Peter & Steele 2001). The Action Plan for Australian Birds (2011) recommends that management actions to stabilise the population should include reducing the overall extent and frequency of fires, and if appropriate, to continue and extend the fox baiting program (Garnett, Szabo & Dutson 2011).

Research has shown that Short-tailed Grasswrens re-occupy burnt vegetation five to seven years after a fire, and reach peak densities 10 to 30 years post fire where large Spinifex covers 65 per cent of the ground (Garnett, Szabo & Dutson 2011). Patch burning of Spinifex, and of Vinba, where encroachment into Spinifex is occurring (Barker 2008), is proposed as a strategy to increase the area of habitat for the Short-tailed Grasswren (Brandle 2013c). The roots of

Vinba suppress the germination of most plant species (Robinson 2013), and so create monoculture communities that are gradually reducing the extent of the Spinifex Hummock Grasslands along these margins.

Management Strategies

Short-tailed Grasswren

- 21.** Develop and implement an Ecological Fire Management Strategy for the Short-tailed Grasswren.
- 22.** During a bushfire, attempt to retain unburnt patches of known Short-tailed Grasswren habitat as refuge areas to minimise the risk of local extinctions.
- 23.** Monitor the effect of fire on Short-tailed Grasswren populations and preferred habitat and use this information in future fire management.
- 24.** Consider patch burning areas of known Short-tailed Grasswren habitat to provide opportunities for colonisation of adjacent areas.
- 25.** Continue and extend the fox baiting program in Short-tailed Grasswren habitat.

Brown Toadlet

The Flinders Ranges form of the Brown Toadlet (*Pseudophryne bibroni*) is a small species of terrestrial frog that occurs across much of south-eastern Australia. It shelters beneath stones or piles of dead vegetation (Tyler 1978). With the onset of heavy autumn rains, its eggs are laid in leaf litter (Brandle 2013a, pers. comm.) often several meters from water (Tyler 1978). The male remains with the eggs until the tadpoles emerge following adequate rain (Willson & Bignall 2009) and are washed into temporary pools (Tyler 1978).

Within the planning area, populations exist around suitable streams and springs within Vulkathunha–Gammon Ranges NP and on the Mawson Plateau at Arkaroola (Brandle 2013a, pers. comm.). The Brown Toadlet is rated as *Rare* in South Australia and near threatened on the IUCN Red List of Threatened Species (Hero et al. 2004). A fire occurring within this species' habitat would be detrimental to the persistence of the Brown Toadlet.

Management Strategies

Brown Toadlet

- 26.** Exclude prescribed burning from creek edges of known Brown Toadlet habitat.
- 27.** Where possible, avoid the use of fire suppression chemicals in known Brown Toadlet catchment areas.
- 28.** If research opportunities arise with prescribed burns, some pre- and post-surveys are recommended to gather more information to inform the DEWNR fauna vital attribute database for use in Ecological Fire Management Guidelines (Appendix 3).

Flinders Ranges Purple-spotted Gudgeon

The Flinders Ranges Purple-spotted Gudgeon (*Mogurnda clivicola*) is a small freshwater fish endemic to the Flinders Ranges. It is nationally *Vulnerable* and *Critically Endangered* in South

Australia. It is the only fish species in the Flinders Ranges known to be a habitat specialist, living in the spring-fed rocky-bottomed streams around Virkundhunha (Balcanoona) (DEH 2009c). It has one of the most restricted distributions of any fish species in South Australia, with a population in Weetootla Creek estimated at 1,200 to 3,200 individuals, and a translocated population of about 70 to 240 fish in Nepouie Spring (McNeil, White & Schmarr 2011). With such limited habitat availability for this species, maintenance of natural spring flows, and persistence of pool and stream habitats is essential for its survival (McNeil, White & Schmarr 2011).

The main potential threat to populations of this fish in the Flinders Ranges is its small, fragmented distribution. The species is highly vulnerable to poor water quality, pest species, and proposed mining (Gillam 2013) as well as random events and climate change (DSEWPC 2013).

Management Strategies

Flinders Ranges Purple-spotted Gudgeon

- 29.** Develop and implement an Ecological Fire Management Strategy for the Flinders Ranges Purple-spotted Gudgeon.
- 30.** Ensure catchment areas supporting Flinders Ranges Purple-spotted Gudgeons are excluded from prescribed burns.
- 31.** Avoid the use of fire suppression chemicals in known Flinders Ranges Purple-spotted Gudgeon catchment areas.
- 32.** Avoid ash from entering waterways known to support the Flinders Ranges Purple-spotted Gudgeon by establishing sediment traps.
- 33.** Liaise with SARDI to rescue, store, and manage fire-affected Flinders Ranges Purple-spotted Gudgeon populations.

Reintroduced Fauna

The Idnya (Western Quoll, *Dasyurus geoffroii*) and the Virlda (Common Brushtail Possum, *Trichosurus vulpecula*) are being re-introduced into the central Flinders Ranges as part of a partnership between DEWNR and the Foundation for Australia's Most Endangered Species. This re-introduction is to investigate whether 20 years of integrated pest management has restored the landscape to a level that will sustain these species. Idnya is listed as *Vulnerable* nationally and *Extinct* in South Australia, and Virlda is locally *Extinct* in the Northern Flinders Ranges and rated *Rare* in South Australia.

Idnya shelter and nest in burrows, hollow logs, trees, and caves. They are nocturnal and spend most of their time on the ground. Females hold large territories, between 0.5 to 1.2 square kilometres, and males roam larger overlapping areas (DEWNR 2013c).

Virlda were once abundant and widely distributed in the arid zone and across Australia. The decline of Virlda in the arid zone of South Australia had mostly occurred by the 1930s with only a few populations persisting longer (Kerle et al. 1992). The decline was predominately due to persistent long periods of drought exacerbated by the severe alteration of high quality refuge patches that would have allowed the Virlda to persist prior to non-Aboriginal settlement. Refuge patches became unsuitable habitat by the combined effects of livestock grazing, introduced herbivores, and fire, as well as the effects of introduced predators (Kerle

et al. 1992). Virlida preferentially occur in long unburnt areas, as these support higher density and larger crops of fruiting understorey plants and may have more large trees with hollows. Anecdotal evidence from previous managers of Wilpena Station suggest a bushfire during the 1950s that burnt Wilpena Creek, through Ikara and Wilpena Gap, was associated with the loss of Virlida from that area (Rasheed 2013). This may have been through the immediate reduction of foliage used for shelter following a fire, or through the reduction in the understorey, and the loss of large hollow-bearing trees (Kerle et al. 1992). However, this is not conclusive as fire can also have a positive effect on Virlida habitat with an increase in food quantity and quality following a fire (Brandle 2014).

Both species are expected to utilise the Heysen, ABC, and Wilpena Range country that runs north-south along the western edge of Ikara—Flinders Ranges NP. Initial signs from the reintroduction of Idnya are positive and breeding has been recorded. Preventing a bushfire that burns the length of this range will be important until both species are widely established.

Management Strategies

Reintroduced Fauna

- 34.** Exclude prescribed burning, and where possible, bushfire from known habitat for reintroduced species until the success of the reintroductions has been confirmed.
- 35.** Once successfully reintroduced, any prescribed burning conducted near Idnya and Virlida habitat will be planned in conjunction with the Bounceback Program.
- 36.** Use information from the reintroduction project about critical habitat information to inform future fire management planning.

Spinifex Hummock Grassland

This grassland community consists of medium to dense Spinifex hummocks, with sparse grasses and forbs growing interspacially; there are usually some shrubs present. It is mostly confined to steep, rocky sites with very poor skeletal soils, and a large proportion of bare ground is usually evident between the hummocks (Hyde 1995).

Hummock grasses are fire dependent and very flammable. The relatively high natural fire frequency of these grassland-dominant areas restricts the range of species that can persist in the same area (Kutsche & Lay 2003). Bushfires in Hummock Grasslands can occur throughout the year but are usually associated with hot summer conditions (Myers et al. 2004). Following fire in Hummock Grasslands, there is a time lag in fuel recovery that is primarily driven by rainfall as well as individual Spinifex species (Myers et al. 2004). Certain fire regimes (e.g. numerous small fires or less frequent large, intense fires) lead to homogeneous stands of Spinifex over very large areas and subsequently, experience damaging effects from large bushfires when they do occur (Myers et al. 2004). Frequent fires contribute to the decline of woody plant species and are therefore linked to the decline of many species of medium-sized mammals as well as reptile species dependent on a mixed plant community (Myers et al. 2004).

The Mount Sunderland country in Ikara—Flinders Ranges NP represents a large connected area of Spinifex with minimal tree and shrub cover, and provides important habitat for a range of species, including the regionally Rare Short-tailed Grasswren (refer to page 24). The apparent expansion of dense stands of Vinba into this area (Barker 2008) has the potential to

reduce habitat quality for the Short-tailed Grasswren. Maintenance of a patchwork of Spinifex age classes in this area through prescribed burning is proposed to reduce the threat to this species, and to maintain Hummock Grassland structure.

Management Strategies

Spinifex Hummock Grassland

- 37.** Maintain vegetation in a range of life-stage cohorts to support fauna, particularly the Short-tailed Grasswren.
- 38.** Consider small-scale burns to areas of dense Vinba clusters where encroachment on Spinifex Hummock Grassland is threatening to alter its structure, and reduce habitat.

3.7 Abundant and Pest Species Management

3.7.1 Fauna

Some fauna species (exotic and native) flourish in post-fire conditions. The impact these species have on biodiversity will depend on a number of factors, including the pre-fire abundance of the species and the characteristics of the fire (e.g. fire size, shape, season, intensity, and location). Herbivores such as Urdlu (kangaroos, *Macropus* spp.) can benefit from post-fire plant regeneration, finding highly palatable food within the recently burnt area (Gill & Catling 2002; Murphy & Bowman 2007). Grazing by abundant herbivores may have a negative impact on the post-fire recovery of vegetation communities.

Within the planning area, a number of introduced fauna have been observed. These include:

- Naniguta (Feral Goat, *Capra hircus*)
- European Red Fox (*Vulpes vulpes*)
- Vusikata (Feral Cat, *Felis catus*)
- Feral Donkey (*Equus asinus*)
- European Brown Hare (*Lepus europaeus*)
- Mausa (House Mouse, *Mus musculus*)
- Black Rat (*Rattus rattus*)
- Rabbit-a (European Rabbit, *Oryctolagus cuniculus*).

Of these introduced animals, arguably the most serious pest across the entire landscape has been the Naniguta (DEH, 2006).

Prior to any prescribed burn, potential impacts will be considered to determine whether post-fire management is required. Management of pest fauna and abundant species is implemented based on a risk assessment. Any Urdlu control program will be compliant with the *DEWNR Kangaroos on Reserves (population control) Policy* (DENR 2011a). Prescribed burning provides opportunities for research and monitoring to be undertaken to inform and improve the management of fauna post-fire. Section 5.3.4 provides more information on prescribed burn planning.

3.7.2 Flora

Weeds can have significant impacts on native vegetation and ecological communities (DPC 2003). Disturbance (e.g. grazing, nutrient inputs, erosion, fragmentation) is likely to promote

weed invasion, and fire in areas already affected by one or more of these disturbance mechanisms is likely to lead to weed proliferation (Hobbs 1991; Hobbs 2002; Hobbs & Huenneke 1992). However, it is also well known that fire is an important source of disturbance in natural systems (Hobbs & Huenneke 1992) and that fire can be used as a tool for weed management, prescribed as part of an integrated approach (Hobbs 2003). An integrated approach to weed management involves the planned use of fire coupled with other weed control techniques (including herbicide, biological, mechanical, and physical control) noting that the combination, timing, and application of methods is likely to differ depending on the target species and to minimise off target damage.

Some of the most significant weed species within the planning area include:

- Buffel Grass (*Cenchrus ciliaris*)
- Salvation Jane (*Echium plantagineum*)
- African Boxthorn (*Lycium ferocissimum*)
- African Rue (*Peganum harmala*)
- Athel Pine (*Tamarix aphylla*)
- Pepper Tree (*Schinus molle*)
- Horehound (*Marrubium vulgare*)
- Wild Hops (*Acetosa vesicaria*)
- Ward's Weed (*Carrichtera annua*)
- Cactus (*Opuntia* sp. and *Cylindropuntia* sp.)
- Onion Weed (*Asphodelus fistulosus*).

Fire management guidelines for these species and other weeds of concern are included in Appendix 2.

Significant weeds within prescribed burn areas will be listed in the prescribed burn plan and mitigation actions identified (DEWNR 2015b). Those weeds identified within the *North Flinders NRM District Weed Strategy* (SAAL NRM Board 2010a) will be addressed as applicable to the planning area. Post-fire weed control will be conducted where necessary; however, investment in weed control will be based on the reserves' overall habitat quality and weed management priorities within the region.

Volunteers, community groups, and DEWNR pest plant programs have completed significant weed management work within reserves. Monitoring programs should ensure that vulnerable areas are evaluated pre- and post-fire to determine what post-fire weed control is required and to assess the effectiveness of control efforts.

Buffel Grass

Buffel Grass (*Cenchrus ciliaris*) has been declared a weed under the *Natural Resources Management Act 2004*, and nominated as a key threatening process under the EPBC Act. It is a perennial tussock grass native to Africa, India, and Asia that was introduced as a pasture and dust suppression species in central Australia (DEWNR & AW NRM Board in prep). It is a high-biomass tussock grass that is generally long-lived, deep rooted and able to out-compete native vegetation (Department of the Environment 2014). It can directly affect native floral diversity and composition, and threatens flora and fauna communities that are not adapted to fire (SAAL NRM Board 2009), by carrying fire into areas where it is not normally part of the ecosystem, and increasing the intensity and frequency of natural fire regimes

(SAAL NRM Board 2010a). Its distribution is expanding in the South Australian Arid Lands NRM Region (SAAL NRM Board 2010b), and climate change likely to further increase spread (Bastin 2014).

In recognition of the weed risk of Buffel Grass across South Australia, but particularly in the state's arid rangelands, Biosecurity SA has developed the *South Australia Buffel Grass Strategic Plan* (Biosecurity SA 2012), along with the *State Buffel Grass Operational Plan* (Biosecurity SA 2010). The operational plan was prepared following a government stakeholder workshop and is being used to guide on-ground management across the state (DEWNR & AW NRM Board in prep.). Nationally, a *Threat abatement advice for ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia due to the invasion of Buffel grass* (Department of the Environment 2014) document has been developed. Advice has been taken from this document and incorporated into the prescribed burn plan template, where relevant. The South Australian Arid Lands NRM Board addresses Buffel Grass in its pest management strategies and a draft *Buffel Grass Management Plan* has been developed (Greenfield 2007). The key management strategies aim to prevent further spread by targeting key pathways of movement, and to reduce the density and extent of established infestations by allocating priority to sites of high conservation value (SAAL NRM Board 2009).

The management strategies adopted in this Fire Management Plan consider those included in the *Ikara—Flinders Ranges Reserve Management Plan* (DEWNR in prep.).

Management Strategies	
Buffel Grass	39. Consider the use of fire as a tool that forms part of an integrated Buffel Grass management strategy.
	40. Ensure hygiene practices are implemented post-fire to prevent Buffel Grass spread.
	41. Conduct regular monitoring to detect the establishment of Buffel Grass.
	42. Consider the likely post-fire response of Buffel Grass and implement post-fire weed control and monitoring.
	43. Investigate the role of fire in Buffel Grass seed dispersal.

3.7.3 Plant Pathogens

Plant pathogens are not considered to be a major threat to biodiversity in the planning area. The risk of Phytophthora (*Phytophthora cinnamomi*) is low due to thin rocky soils and low rainfall, however, it has been recorded nearby in Bimbawrie CP, and as such precautions should be taken with plant and equipment sourced from other areas.

DEWNR has a Standard Operating Procedure that outlines hygiene procedures and guidelines to minimise the risk of Phytophthora infestation and spread in DEWNR-managed reserves (DEH, 2002).

Management Strategies

Abundant and Pest Species Management	<p>44. Consider the use of fire as a tool that forms part of integrated pest management strategies.</p> <p>45. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring.</p> <p>46. Collect relevant information during prescribed burn planning on abundant and pest species, and undertake a risk assessment to determine the need for post-fire management.</p> <p>47. Adhere to the <i>Standard Operating Procedure – Phytophthora Threat Management (SOP-002)</i> (DEH 2002a).</p> <p>48. Ensure hygiene practices are implemented to reduce the spread of weeds and Phytophthora across the planning area. Refer to the <i>DEWNR Operating Procedure – Phytophthora Vehicle Disinfection Unit</i> (DEH 2003).</p>
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4 RISK

4.1 Risk Assessment

A risk assessment was conducted in line with the *Risk Assessment in DEWNR Fire Planning Procedure* (DEWNR 2015b), as a requirement for the compilation of this Fire Management Plan. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property, culture, and environmental values in the planning area. The risk assessment considered visitor use, assets (built, cultural, and natural values), and neighbouring properties for all reserves in the planning area. Risk assessment is a function of likelihood and consequence.

- Likelihood considers the possibility that a fire related risk will occur and is rated as Rare, Unlikely, Possible, Likely, or Almost Certain.
- Consequence considers the outcomes of bushfire based on impacts to life, property, and environmental values and is ranked as Insignificant, Minor, Moderate, Major, or Critical.
- Based on the derived likelihood and consequence ratings, the overall risk for each scenario is determined using a Risk Matrix and ranked as Low, Moderate, High, or Extreme.
- Where an overall risk rating of High or above has been identified, risk mitigation strategies have been developed. Section 5.3 discusses risk mitigation strategies.

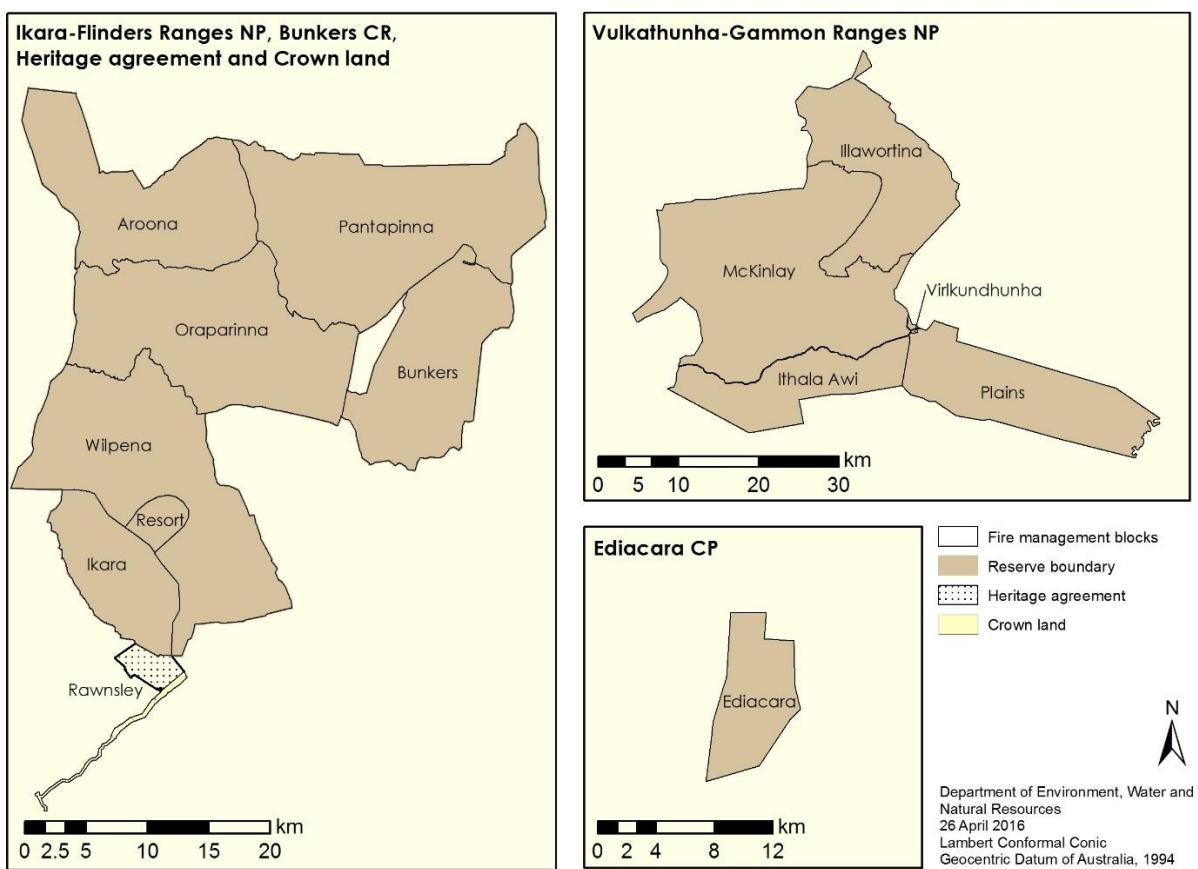
The *Risk Assessment in DEWNR Fire Planning Procedure* (DEWNR 2015b) provides more information on this process. Risk assessment is ongoing and regularly reviewed to reflect the changing landscape. The application of fire management zones as well as recommended actions and works in this plan are derived from the risk assessment process.

4.1.1 Fire Management Blocks

The planning area has been divided into 14 Fire Management Blocks to ensure that information and issues unique to each particular area have been addressed (Table 5 and Figure 2). Block boundaries are based on access and the practicalities of implementing fire management objectives.

TABLE 5 – FIRE MANAGEMENT BLOCK INFORMATION

Included lands	Block	Area (ha)
Ikara–Flinders Ranges National Park	Aroona	15,692
	Oraparinna	21,630
	Pantapinna	25,043
	Resort	1,415
	Wilpena	22,678
	Ikara	7,926
Vulkathunha–Gammon Ranges National Park	Virkundhunha	36
	Ilawortina	26,274
	Ithala Awi	16,636
	McKinlay	57,241
	Plains	25,537
Ediacara Conservation Park	Ediacara	4,764
Bunkers Conservation Reserve	Bunkers	15,127
Heritage Agreement, Crown land	Rawnley	1,703

**FIGURE 2 – FIRE MANAGEMENT BLOCKS**

4.2 Fuel Hazard

4.2.1 Overall Fuel Hazard

The overall fuel hazard is used in fire management planning to determine the level of risk posed by bushfire to life, property, culture, and environment. The overall fuel hazard is

derived from the assessment of four fuel layers in vegetation: Surface, Near surface, Elevated, and Bark Fuel as illustrated in Figure 3. Canopy Fuel is not measured as part of overall fuel hazard.

Each fuel layer contributes to different aspects of fire behaviour: flame depth and height, surface fire combustion and rate of spread, spotting and crown fire. Each individual layer, as well as the overall fuel hazard, can be assessed as: Low, Moderate, High, Very High, or Extreme (DENR 2011b).

Research completed by McCarthy and Tolhurst (2004) investigated the effectiveness of fuel reduction burning in Victoria. It was concluded that maintaining overall fuel hazard levels at High or less aids in slowing the rate of spread of a subsequent bushfire. It was determined that to achieve long-term fuel reduction effects, the focus should be on the reduction of bark and elevated fuels as these fuel layers are likely to contribute most to the overall fuel hazard.

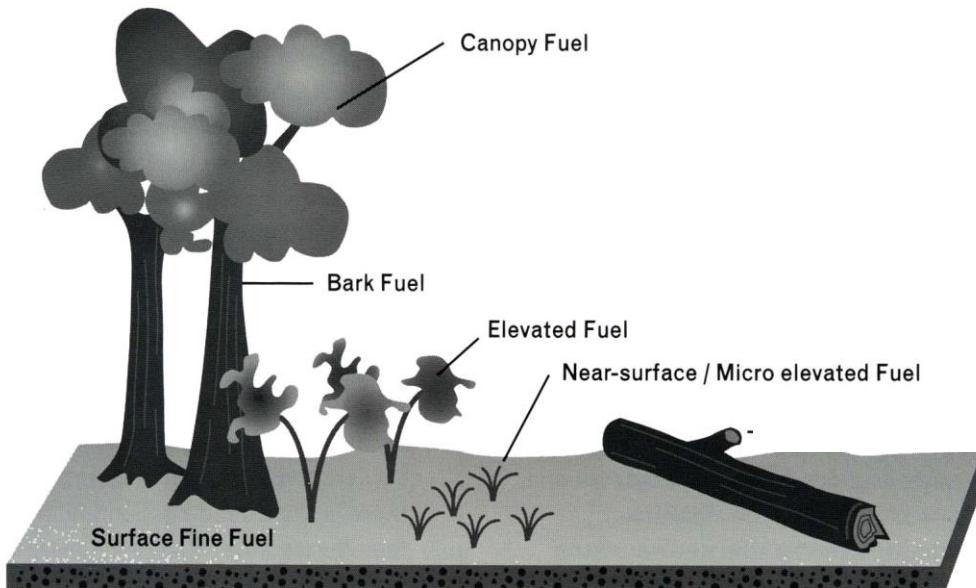


FIGURE 3 – COMPONENTS OF FUEL IN VEGETATION

(Tolhurst & Cheney 1999)

The general pattern of fire incidents in semi-arid and arid regions such as those within the planning area is often, but not always, characterised by fire following rain, due to ephemeral grass growth that generally results from significant rainfall in an otherwise dry environment (Brandle 2013b). Gill (2000), analysed 100 year rainfall data for Alice Springs and found that these suggested a major fire cycle of around 50 years.

Fuel loads within a particular area will be influenced by the types of vegetation (floristics) found in the landscape. Arid and semi-arid acacia low open woodlands and shrublands with a chenopod understorey, which corresponds with low fuels, dominate the vegetation communities within the planning area. This can explain the history of relatively few recorded bushfires in this area (see Section 3.4.2).

For more information on fuel hazard assessment methodology and evaluation refer to the *Overall Fuel Hazard Guide for South Australia* (DENR 2011b). DEWNR maintains a database containing fuel hazard assessment records. The process for recording and submitting fuel hazard data is explained in the *Fuel Hazard Assessment Procedure* (DEWNR 2015b).

4.2.2 Likely Maximum Overall Fuel Hazard

Maximum overall fuel hazard levels have been estimated for MVS within the planning area to provide a guide for fire management (Table 6). The process used to derive MVS is described in Section 3.5 and the extent of each MVS within the planning area is shown on the Vegetation Communities map (map 2; [online](#)).

The likely Maximum Overall Fuel Hazard is based upon on-ground sampling and vegetation mapping within the planning area. It can be used for planning and incident management; however, this estimate should be supported by on-ground inspection as areas of vegetation remain unmapped. It is likely that other factors (such as high weed density) will influence the overall fuel hazard.

TABLE 6 – LIKELY MAXIMUM OVERALL FUEL HAZARD FOR MVS IN THE PLANNING AREA

MVS No.	MVS Name	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
8	Eucalyptus woodlands with a shrubby understorey	Moderate	Surface
12	Callitris forests and woodlands	High	Elevated
20	Mulga (<i>Acacia aneura</i>) woodlands and tall shrublands with tussock grass	Low*	Elevated*
21	Other Acacia tall open shrublands and shrublands	Low*	Elevated*
22	Arid and semi-arid acacia low open woodlands and shrublands with chenopods	Low	Surface, Elevated
24	Arid and semi-arid acacia low open woodlands and shrublands with tussock grass	Low	Near surface, Elevated
26	Casuarina and Allocasuarina forests and woodlands	Low	Bark
27	Mallee with hummock grass	Low	Surface, Near surface
29	Mallee heath and shrublands	Very High	Bark
31	Chenopod shrublands	Low*	Near surface, Elevated
32	Other shrublands	Low	Elevated
33	Arid and semi-arid hummock grasslands	Moderate	Near surface
34	Mitchell grass (<i>Astrebla</i>) tussock grasslands	Moderate*	Near surface*
37	Other tussock grasslands	Moderate	Near surface
39	Mixed chenopod, samphire or forblands	Low*	Near surface
47	Eucalyptus open woodlands with shrubby understorey	Moderate*	Surface
55	Mallee with an open shrubby understorey	High	Elevated, Bark

* denotes estimated likely maximum overall fuel hazard based on similar fuel types

4.3 Potential for Fire Impact

The planning area covers co-managed reserves that receive high visitation during specific times of the year. Coupled with the access limitations due to terrain, the likelihood of private citizens being injured or killed by a bushfire on these lands is considered High in some areas

of Ikara—Flinders Ranges and Vulkathunha—Gammon Ranges NP. Fuel quantity, which contributes to fire hazard, can be highly varied and seasonal. During a wet year, surface fuel can be present and can increase the overall fuel hazard. During a dry year, fuel will contain less moisture and so be generally more combustible, but fire has difficulty spreading, as the surface fuel is sparse and discontinuous.

Ikara and the adjacent Wilpena Pound Resort and Campground within Ikara—Flinders Ranges NP receive the majority of the 100,000 annual visitors. Public access to these areas is only via Wilpena Road to the east, and should a bushfire move through this area, it could be devastating to human life and property as there are no other evacuation routes. There are also significant built assets at Wilpena that support the resort and community, such as the solar power plant, remote area power system, and telephone infrastructure, along with the major investment of the resort itself. The major water source for the area is found along the multi-use Pound Track. Bushfires within Ikara can cause major issues for firefighters with few water sources and steep terrain limiting access and communications.

Bushfires are uncommon within Vulkathunha—Gammon Ranges NP with very little fire history recorded for the park. The most recently recorded fire event occurred in a small portion of the McKinlay block in 2007. The main challenge for firefighting within the park is the steep terrain, and a one-way tourist drive along the range with blind crests and steep drop offs. Evacuation of visitors during a bushfire would be hampered by poor communications and the large size and isolation of the park. Many areas of the park are only accessible by foot and bushwalkers would be vulnerable in the event of a bushfire.

The threat of entrapment during a bushfire for the Yellow-footed Rock-wallaby Preservation Association members and invited visitors within Bunkers CR is High. This is a result of the steep terrain and lack of quick exit points. It is important that landscape-scale fuel management is implemented along the boundaries to reduce the risk of a bushfire impeding safe egress.

The main fire management issue for Ediacara CP is that a bushfire suppression operation could cause damage to the internationally important Ediacaran fossils. The likelihood of this occurring is Unlikely as should a fire burn within the park it would not require suppression under usual conditions. The vegetation within Ediacara is sparse and fire is unlikely to spread; the park has no recorded previous fire history; and due to the remoteness of the area, a 'watch and wait' strategy would likely be implemented.

4.3.1 Vurndu

Vurndu (smoke) is made up of a range of particles and gases including carbon monoxide, carbon dioxide, nitrogen oxides, volatile organic compounds, and water vapour. These particles can impact on human health with the largest risk coming from the microscopic particles (SA Health 2009).

Health

Small particles from vurndu can enter via the eyes, nose, and respiratory system (SA Health 2009), where they can cause irritation and inflammation, manifesting into a number of health effects. Children and the elderly are particularly susceptible to the health effects of vurndu and pre-existing illnesses such as chronic obstructive pulmonary disease (COPD), asthma, and heart disease may deteriorate due to vurndu inhalation (DOH 2012; SA Health 2009).

Under CFS Standard Operating Procedures (5.1), advice will be provided to the public during a fire event (CFS 2013). Generally, the CFS advises that people affected by vurndu should

close all doors and windows and stay indoors. If outside, the use of a vurndu mask that meets the Australian Standard AS1716 or 'P2' or 'P3' is recommended (SA Health 2009).

Management Strategies

Vurndu

- 49.** When available, assess vurndu modelling projections from the Bureau of Meteorology, and information from the Environmental Protection Agency (EPA) to consider vurndu management prior to burning operations.

4.3.2 Influence of a Changing Climate

There is potential for climate change to influence fire regimes and fire management practices into the future (see Section 3.2) and this has implications for biodiversity and the community across the planning area. Therefore, it is acknowledged that adaptation of fire management strategies to improve resilience may be required in the future in response to climate change.

It is recommended that DEWNR undertake the following initiatives:

Management Strategies

Changing Climate

- 50.** Support research of species and ecosystems to inform future fire management strategies in a changing climate.
- 51.** Review and adapt fire management strategies in the plan area as the impacts of climate change become understood.
- 52.** Monitor national and international fire management policy and best practice, and partner with the research sector to increase our knowledge of altered fire regimes.

5 READINESS

5.1 Equipment

DEWNR maintains specialised fire suppression equipment and communications systems to optimise fire management and response capabilities. These resources form part of the standard CFS response on public land and may be deployed to fires anywhere in South Australia or interstate. The CFS brigade that is based at Wilpena is a collaboration of CFS volunteers and DEWNR firefighters.

DEWNR issues personal protective equipment that is consistent with Australian Standards (where they exist), CFS requirements, and Australasian Fire and Emergency Services Authorities Council Knowledge Web guidelines.

All firefighting equipment is inspected prior to the start of the fire season and after use at fires to ensure that minimum requirements are met as prescribed in DEWNR policies and standards.

5.2 Training

Firefighting is a specialised activity with a range of associated hazards. All DEWNR firefighters are trained to carry out their duties safely and recognise hazardous situations. DEWNR staff involved, directly or indirectly, in the management of fire incidents are required to complete the Basic Firefighting Level 1 CFS course at a minimum.

All DEWNR personnel engaged in fire management operations are trained in accordance with the *Fire Training Procedure* (DEWNR 2015b) and CFS standards. All staff involved in fire suppression are required to undertake annual pre-season training and health checks and meet fitness requirements to ensure that they are able to carry out assigned duties safely and competently (see the *Fire Personnel Health and Fitness (Fighting Fit Program) Procedure* for details (DEWNR 2015b)).

DEWNR is committed to maintaining a safe working environment during fire operations in compliance with the *Work Health and Safety Act 2012*, consistent with the *Work Health & Safety and Injury Management Foundation Policy* (DEWNR 2013f), and the *Safety, Health and Welfare Procedure* (DEWNR 2015b).

5.3 Risk Mitigation Strategies

5.3.1 Fire Access Tracks

DEWNR manages a strategic network of fire access tracks on DEWNR-managed land, in accordance with the *Government Agencies Fire Management Working Group* (GAFMWG) standard (GAFMWG 2014), and the *Fire Access Tracks Procedure* (DEWNR 2015b). Tracks occurring within the planning area, as well as external tracks/public roads considered important for fire suppression have been classified as a Major, Standard, or Minor track according to the GAFMWG standard. Tracks that are considered unsuitable for fire suppression have been classified as Service tracks and should not be used during fire suppression operations, unless verified by on-ground inspection and with the approval of the Incident Controller. The *Fire Management and Access map* (map 4; [online](#)) shows fire access tracks according to their GAFMWG classification.

Tracks that are identified as important for fire suppression are usually located in low fuel areas, supported by fire management zoning, or may be positioned between significant assets (e.g. Wilcolo track, the Wilpena Pound access track). Many tracks within the Northern Flinders Ranges planning area are steep, rocky, and one-way with limited turn-arounds (e.g. Loop

Track). These tracks are often also multiple-use, and used by walkers and/or tour buses. This will be taken into consideration during fire suppression activities and prescribed burn planning.

Fire access points and tracks have been audited as part of this plan and proposed changes are summarised within Appendix 1, including creating GAFMWG standard signage; other tracks will be maintained to their current GAFMWG standard. Actions will be implemented on a priority needs basis, subject to resources, fuel hazard, and risk. The design and location of any new fire access tracks, after approval by the Co-management Boards, will take into consideration topography, soil type, and low fuel hazard areas to provide for the safety of firefighters during suppression.

Management Strategies

Fire Access Tracks

- 53.** Maintain all fire access tracks to the current GAFMWG standards as shown on the Fire Management and Access map (map 4; [online](#)).
- 54.** Install signs on fire access tracks and gates according to GAFMWG standards and name tracks as appropriate.

5.3.2 Fire Infrastructure

Various fire infrastructure is maintained for fire suppression activities within the Northern Flinders Ranges planning area, these have been mapped and are shown on the Fire Management and Access map (map 4; [online](#)). There is a concentration of fire infrastructure at Wilpena to protect the significant built assets and high numbers of tourists. Wilpena is commonly used as the incident control centre during a bushfire in the area. The tower at Mount Caernavon within Bunkers CR, and the tower at Mount Mathari within Ikara—Flinders Ranges NP, are used during fire operations for radio communications and are maintained by Telstra under a state government contract. There are standpipes and water tanks located around Wilpena to supply firefighting appliances. It is important for the continued safety of the visitors and staff of the Wilpena Pound Resort and Campground that the lease obligations are adhered to in regards to legislated fire requirements.

Vulkathunha—Gammon Ranges NP relies on the UHF repeater station at Mount Benbonya the for all phone and internet communications. This tower is also critical infrastructure for the Beverly mine operation. The Plains block of Vulkathunha—Gammon Ranges NP contains a bitumen airstrip and 24-hour lighting, but is not CFS approved and a suitable water supply for firebombing aircraft is not present.

For the remainder of the planning area, fire infrastructure is minimal with a limited number of static water supplies (mainly tanks). The *Bushfire Response Plan for the South Australian Arid Lands Region* (DEWNR 2013b, 2013e), as well as the South Australian Arid Lands Region annual works schedule, provides more information on fire infrastructure.

5.3.3 Fire Management Zones

Fire management zones as detailed in the *Fire Management Zoning Procedure* (DEWNR 2015b) are used in fire management planning to:

- ensure that appropriate management actions are implemented to meet the requirements for asset protection and ecological management on reserves

- clarify the areas where different fire management activities will be undertaken on reserves
- ensure a standard approach to the application of fire management zones on reserves across South Australia.

Fire management zones are categorised according to the primary objective for fire management: Asset Protection zone (A-zone), Bushfire Buffer zone (B-zone), or Conservation-Land Management zone (C-zone). Where A- or B-zones are not applied, C-zone is the default zone type. These zones are determined giving consideration to overall fuel hazard levels in different vegetation types, and the level of risk to assets including life, property, cultural values, and biodiversity assets. The primary objective within A- and B-zones is fuel management; Section 5.3.5 describes the purpose of C-zones. The zones allocated to the included lands within the planning area are described in Appendix 1 and shown on the Fire Management and Access map (map 4; [online](#)).

The following general objectives apply for fire management zoning across the reserves in the planning area.

Asset Protection Zone Objectives

To ensure the overall fuel hazard does not exceed Moderate, in order to:

- provide a reduced fuel area of at least 40 m in width to help protect life (owners/firefighters) and property/built assets from radiant heat damage, flame contact, and short distance ember attack.
- modify the rate of spread and fire intensity providing the highest degree of safety for fire crews during suppression.

Bushfire Buffer Zone Objectives

To ensure the overall fuel hazard does not exceed High, in order to:

- minimise the likelihood of bushfire impacting on property and ecological assets.
- assist in reducing bushfire intensity, ember attack, and spotting potential, likely to impact on assets within the included lands.
- provide a suppression advantage to assist in containing bushfires within defined areas, that is to minimise the likelihood of fires entering the reserve from the wider landscape or exiting the reserve.
- reduce the likelihood that significant areas of contiguous vegetation burn in a single fire event.
- enhance safe access for firefighters.

Conservation-Land Management Zone Objectives

C-zone management is not dictated by the overall fuel hazard, rather zoning allows for fire management to meet ecological and conservation management objectives. Proposed burns in C-zones will be applied where necessary to:

- assist in the conservation of species and populations such as the species listed in Appendices 2 and 3, as well as threatened ecological communities listed in Appendix 4, through the application of appropriate fire regimes.
- reduce the likelihood of contiguous vegetation burning in a single fire event.
- promote heterogeneity within the environment through the creation of variability in the fire regime.
- use fire as part of an integrated weed management program to improve bushland quality.
- manage fire within the Ecological Fire Management Guidelines for MVS.

Major Strategies within the Planning Area

The following provides an overview of the major strategies that were developed based on the risk assessment.

- A-zones of 40 m width have been applied to significant assets within the planning area to increase visitor protection and to reduce the likelihood of assets being irreparably damaged.
- B-zones of 100 m width have been located adjacent most A-zones to provide further protection for visitors and assets. The major roads have also been buffered to reduce the impact of bushfire on escape routes.
- C-zone burning appropriate for the protection of Yura Muda.
- C-zone burning managed in accordance with ecological guidelines as part of ecological restoration and research into fire as an ecological process, such as patch-burning of Triodia Hummock Grassland to provide long-term habitat for the Short-tailed Grasswren.

These and other zones applied to the lands included in the Fire Management Plan are shown on the Fire Management and Access map (map 4; [online](#)) and detailed in Appendix 1. Note that the mapped extent of these zones and proposed burns as currently mapped is indicative and the widths and locations will be more clearly defined in prescribed burn plans. Burns undertaken for cultural purposes by the Adnyamathanha community may not be formally mapped.

At the time of writing, there is no formal process in place for undertaking fire management strategies, including prescribed burns, on private lands. The implementation of all management activities recommended in this plan is important to the effectiveness of the plan overall. In the interim, recommendations for private lands will be referred to the Outback BMC for consideration and implementation.

Prescriptions for Fuels in A- and B-zones

Overall fuel hazard is assessed via on-ground observations. The *Overall Fuel Hazard Guide for South Australia* (DENR 2011b) assists fire management personnel to identify the hazard posed by Surface, Near surface, Elevated, and Bark fuels. The fuel hazard levels are then assessed against a table to determine the Overall Fuel Hazard rating.

The overall fuel hazard:

- should not exceed Moderate for the areas designated as A-zones

- should not exceed High for the areas designated as B-zones.

Fine fuels (less than 6 mm), particularly in the Near surface and Surface layers, contribute the most to a fire's rate of spread and flame height (DSE 2010). The Elevated fuel layer significantly contributes to flame height and increases fire intensity (DSE 2010). Bark fuel (particularly stringy-bark) produces burning embers that can generate spotting (DENR 2011b), causing new fires or the ignition of other flammable objects (houses, sheds etc.). These fuel layers are targeted during prescribed burning operations and is the reason prescribed burning is highly effective in fuel hazard reduction. Other fuel reduction activities such as selective thinning, weeding and slashing, which also target these fuel layers, can significantly reduce bushfire impacts.

In A- and B-zones, fuel management will be undertaken to achieve the desired level of overall fuel hazard, once it exceeds the prescribed limit. Note that within C-zones management is not dictated by overall fuel hazard levels, rather zoning allows for fire management to meet ecological and conservation management objectives. The primary fire management action in C-zones is prescribed burning.

Details on fuel reduction methods within A- and B-zones are provided as part of an environmental assessment process, which is completed before the implementation of each prescribed burn (see Section 5.3.4) and also before new fire management works are undertaken within Co- and DEWNR-managed land (where native vegetation is being cleared and is not exempt under the Native Vegetation Act 1991). Refer to the *Fire Information Management System – User Guide* (DEWNR 2014) and the *Prescribed Burning Procedure* (DEWNR 2015b) for more information.

5.3.4 Prescribed Burning

Prescribed burning is the planned application of fire within prescribed environmental conditions and predefined boundaries, either for bushfire risk mitigation or to achieve ecological or research objectives. DEWNR has developed operational prescriptions outlining the preferred range of weather variables for the different vegetation types suitable for prescribed burning (DEWNR 2015b).

Under DEWNR policy, individual prescribed burn plans are prepared and approved for every prescribed burn regardless of the objective (DEWNR 2015b).

Prescribed burn plans include:

- the objective of the prescribed burn, e.g. fuel reduction, ecological benefits, or research purposes, and the area to be treated
- an environmental assessment of potential impacts on threatened species and ecological communities, cultural heritage, significant weeds, and vegetation age classes; for burns in C-zones, the application of the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a). Mitigating actions are implemented where impacts are identified. Burn plans are given an overall environmental impact rating of Low or High impact
- an operations plan detailing:
 - fuel hazard assessments,
 - prescriptions for the burn based on strategic objectives,
 - production of operational maps,

- site preparatory work required before the burn is conducted,
- forecasted weather,
- the strategies and tactics to achieve the desired objectives,
- the personnel required and their command,
- plant and equipment,
- site-specific safety considerations including control lines, fall-back lines, evacuation plans, and escape routes,
- permits required, and
- notifications to other agencies and stakeholders
- a burn risk assessment assessing the risk of escapes, potential for off-target damage, effectiveness of mitigation strategies, the potential for the burn to meet its objectives
- pre- and post-prescribed burn monitoring and follow-up works.

Approvals for prescribed burn plans vary depending on the level of complexity and risk. Where native vegetation is being treated, the environmental assessment is endorsed by regional staff, including those with ecological expertise. Where a burn is deemed to be 'low impact', plans are approved internally within DEWNR (DEWNR 2015b). A burn is deemed to be 'High impact' where the environmental assessment determines that there is the potential for significant impacts on any of the Principles of clearance of native vegetation (Schedule 1) under the Native Vegetation Act 1991. High impact prescribed burn plans are submitted to the Native Vegetation Council for approval, unless they form part of a Fire Management Plan already endorsed by the Native Vegetation Council.

Where matters of national environmental significance are likely to be significantly impacted, approval is required from the Commonwealth Department of the Environment under the EPBC Act. All prescribed burning in the planning area requires consultation with an Adnyamathanha authorised officer, and senior ecological DEWNR staff. Operations plans are approved by the nominated Incident Controller for each burn.

Prescribed burning in zones identified on the Fire Management and Access map (map 4; [online](#)) may not be treated in their entirety at one point in time, as the area may be divided and treated over a number of seasons, or the treated area may be patchy for environmental purposes or due to conditions at the time of the prescribed burn.

5.3.5 Prescribed Burning in C-zones

Under DEWNR policy, prescribed burning within C-zones may be implemented for purposes of ecological management, cultural management (such as burning by Aboriginal people, refer to *Clearance of native vegetation through Aboriginal cultural resource use activities under regulation 5(1)(zi)* (Native Vegetation Council 2015)), research, or for landscape protection (DEWNR 2015b). A clearly defined, strategic program of landscape protection C-zone burning may be an appropriate way to mitigate the risk of a whole block/reserve/area burning in a single bushfire event (DEWNR 2015b). All prescribed burning within C-zones should be in accordance with the Ecological Fire Management Guidelines (EFMG) described within this Fire Management Plan (see Section 5.4).

Ecological Prescribed Burns

Prescribed burns within C-zones may be carried out for specific ecological purposes, including the management of vegetation age-classes, weed management, and

management of threatened species or ecological communities, as well as non-threatened fauna and flora. Ecological prescribed burns are conducted in accordance with the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a), which are described in Section 5.4 of this plan. Where a proposed prescribed burn is not included in an approved management plan or other statutory document that outlines the requirements for application of fire regimes, an Ecological Burn Rationale must be prepared and approved as per the *Ecological Burning Procedure* (DEWNR 2015b).

The Native Vegetation Council Guidelines, *Ecological Prescribed Burning under Regulation 5(1)(zi)* (Native Vegetation Council 2014) under the Native Vegetation Act 1991 also apply to these prescribed burns. All ecological burns on Co- and DEWNR-managed land require approval by the Native Vegetation Council under Native Vegetation Regulation 5(1)(zi).

Landscape Protection Prescribed Burns

Prescribed burns within C-zones may be carried out for landscape protection purposes, where the reduction of fuel in a particular area reduces the likelihood of a whole reserve or large contiguous block of vegetation burning in a single fire event. Unlike prescribed burns in A- or B-zones, there are no fuel management prescriptions for landscape protection prescribed burns, instead they are guided by the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a).

Proposed prescribed burns in C-zones are listed in Appendix 1 and shown on the Fire Management and Access map (map 4; [online](#)). These burn areas are intended to be implemented over the life of the plan and may be added to, altered, relocated, or withdrawn at the discretion of DEWNR or the Co-management Boards at any time. Generally this would be as a result of unplanned fires or other factors that may have occurred since time of writing, for example the incidence of drought or heavy rain. The implementation of any proposed burn is subject to suitable weather, resource availability, and regional priorities.

Within this planning area, proposed C-zone prescribed burns have ecological protection objectives.

5.4 Ecological Fire Management

The management of fire to maintain or enhance biodiversity is based on knowledge of the vital attributes (Noble & Slatyer 1980) of flora and fauna species, populations, and communities exposed to different fire regimes. Vital attributes are a functional approach to fire response based on groups of species that share critical life history characteristics. Consideration is given to the method of persistence after fire (e.g. seeding or re-sprouting), the environmental requirements for successful re-establishment (e.g. competition or some form of preconditioning), and the lifespan of the different stages within the lifecycle (e.g. time to become reproductive). A functional approach such as this can provide a means of both understanding and predicting species' response to a particular fire regime, with the specific objective of being able to predict the changes in plant communities subject to recurrent disturbance.

There are currently limited data available on the fire-related requirements of many fauna taxa, so these guidelines are based predominantly on the plant vital attribute information, that have been compared against known fauna requirements. DEWNR collects vital attributes for flora and fauna. This approach is being used as a sound basis for the management of fire for biodiversity across Australia (Andersen, Cook & Williams 2003; FEWG

2004; Hopkins & Saunders 1987; Whelan et al. 2002) and is used to assist in achieving management objectives in C-zones within all Co- and DEWNR-managed Fire Management Plans and across agencies.

5.4.1 Methodology

The approach for determining the EFMG for the different MVS is described in detail in the *Ecological Fire Management Guidelines for Native Vegetation in South Australia* (DEWNR 2013a). Briefly, the species most susceptible to decline from inappropriate fire regimes need to be identified using best available knowledge of plant vital attributes and life histories. These species (known as Key Fire Response Species - KFRS), and their needs in relation to the components of fire regime, provide a guide to the acceptable thresholds of fire regime for the community (Thresholds of Potential Concern - TPC). Thresholds of Potential Concern are defined as 'the limits of tolerance to a particular fire regime' (Kenny et al. 2004).

Of particular importance are two TPC relating to the **fire interval** component of the fire regime:

- **TPC1** describes the lower threshold for fire interval (years between fires) for a particular MVS. That is, vegetation within this MVS will be represented predominantly by early successional species if the inter-fire interval is less than the time specified, and those species that require longer to flower and set seed can disappear from a community. The KFRS that typically determine TPC1 are those species with the longest juvenile period (i.e. time to adequately set seed or reproduce)
- **TPC2** describes the upper threshold for fire interval (years between fires) for a particular MVS. That is, populations of some species (e.g. obligate seeders) are likely to reduce within this MVS if fire is absent for more than the time specified. The KFRS that typically determine TPC2 are those species with the shortest extinction period (i.e. time until regeneration from seed or reproduction is no longer possible)

Fire intervals between TPC1 and TPC2 (Table 6) are predicted to maintain the species complement, whereas intervals shorter than TPC1 or longer than TPC2 are predicted to lead to the decline of the KFRS (Kenny et al. 2004).

Aspects of intensity, season, and extent are then considered in regards to what is known of their likely impact on the KFRS.

In summary, the steps taken in the development of the EFMG are as follows.

- Vital attributes data for flora are gathered and assessed.
- This knowledge is used to identify the KFRS, which help to identify the TPC of fire regime (fire interval, intensity, and season).
- Fire regime thresholds using flora are assessed for potential impacts on known faunal requirements, particularly the requirements of species of conservation significance.
- EFMG are formed from these thresholds and are then used to guide the fire management practices to ensure that adequate habitat is available to maintain biodiversity (i.e. species, populations, and communities).
- EFMG are reviewed periodically as new information becomes available.

Figure 4 (below) illustrates this process.

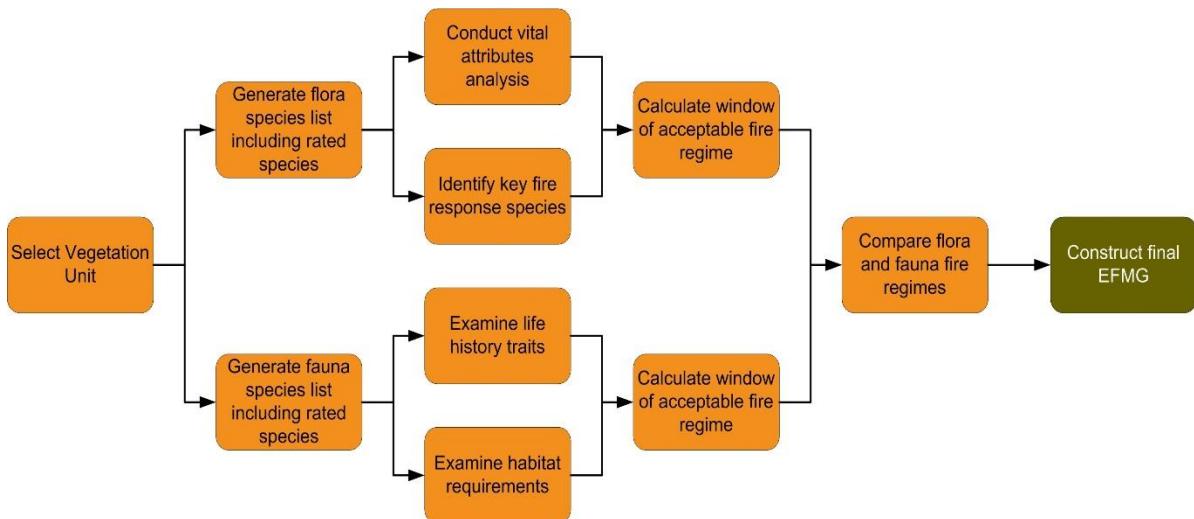


FIGURE 4 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

5.4.2 *Interpreting Ecological Fire Management Guidelines*

EFMG have been defined for MVS within the planning area (Table 7), to assist strategic planning and management of fire within the reserves in the planning area in a way that will support the maintenance and enhancement of biodiversity.

Guidelines for five aspects of fire regime (interval, frequency, spatial, intensity, and season) have been determined for all MVS within the planning area (where data are available). The upper and lower TPC for a particular MVS have been proposed, as well as recommendations on the management of fire frequency. Fire intensity requirements for species regeneration and undesired seasonal burning patterns have also been identified. EFMG should not be used as prescriptions; instead they define a window of ‘acceptable’ fire regime that supports the conservation of existing species. The EFMG are based on the best available information and they will be refined as new research and monitoring data become available for KFRS.

TABLE 7 – ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR MVS IN THE PLANNING AREA

MVS No		ECOLOGICAL FIRE REGIME								
		Interval		Spatial Criteria		Frequency		Intensity		Season
MVS NAME		TPC1: Lower threshold in years	TPC2: Upper threshold in years	Inter-fire intervals within TPC1 & TPC2 across more than X% of the extent of this MVS within the planning area		% > TPC2	Avoid more than 2 fires within a period of X years	Avoid more than 2 successive fires of low intensity (Yes/No)	Some medium to high intensity fire needed to regenerate some species (Yes/No)	Avoid more than 1 successive fires in season
8	Eucalyptus woodlands with a shrubby understorey	20	50	40	30	60	Y	Y	Spring or during & following drought	
12	Callitris forests and woodlands	15	60	40	30	70	Y	Y	During & following drought	
20	Mulga (<i>Acacia aneura</i>) woodlands and tall shrublands with tussock grass	20	60	40	30	100			During & following drought	
21	Other Acacia tall open shrublands and shrublands	10	50	40	30	60	Y	Y	During & following drought	
22	Arid and semi-arid acacia low open woodlands and shrublands with chenopods	20	60	40	30	70			During & following drought	
24	Arid and semi-arid acacia low open woodlands and shrublands with tussock grass	10	60	40	30	70			During & following drought	
26	Casuarina and Allocasuarina forests and woodlands	20	50	40	30	60	N	N	During & following drought	
27	Mallee with hummock grass	20	50	40	30	60	Y	Y	During & following drought	
29	Mallee heath and shrublands	20	40	40	30	40	Y	Y	Spring or during & following drought	
31	Chenopod shrublands	Avoid prescribed burning								
32	Other shrublands	20	35	40	30	40			During & following drought	

ECOLOGICAL FIRE REGIME										
MVS No	MVS NAME	Interval			Spatial Criteria			Frequency	Intensity	Season
		TPC1: Lower threshold in years	TPC2: Upper threshold in years	% > TPC2	Inter-fire intervals within TPC 1 & TPC2 across more than X% of the extent of this MVS within the planning area					
33	Arid and semi-arid hummock grasslands	10	50	40	30	60	Y	Y	During & following drought	
34	Mitchell grass (<i>Astrebla</i>) tussock grassland	3	15	40	30	20	N	N	Autumn	
37	Other tussock grasslands	3	15	40	30	20	N	N	Autumn	
39	Mixed chenopod, samphire or forblands	Avoid prescribed burning								
47	Eucalyptus open woodlands with a shrubby understorey	20	50	40	30	60	N	N	During & following drought	
55	Mallee with an open shrubby understorey	20	40	40	30	40	Y	Y	Spring or during & following drought	

6 RESPONSE

6.1 Response Plans

A Response Plan exists for the South Australian Arid Lands Region (DEWNR 2013e), which is reviewed on an annual basis in accordance with the Response Planning Procedure (DEWNR 2015b). The reserves included in this Fire Management Plan are within the Ranges District Response zone. The response plan provides reserve-specific information in relation to fire suppression including water points, equipment and access, as well as levels of readiness.

Note that the Response Plan is for initial response only and that the Incident Controller should refer to this Fire Management Plan for more detailed fire management information, in conjunction with an Adnyamathanha authorised officer and other DEWNR staff.

6.2 Suppression Considerations

Consideration for firefighter safety and the protection of life are paramount during all suppression operations. An Adnyamathanha authorised officer and/or DEWNR Liaison Officer should be assigned to incidents occurring on DEWNR and Co-managed land. The role of the Adnyamathanha authorised officer and the DEWNR Liaison Officer is to coordinate and work with Incident Management to protect cultural heritage values. The DEWNR Liaison Officer also provides policy advice, as well as resources and other logistical and planning support.

Initial efforts to contain bushfires should be made using existing access tracks, previously burnt areas and natural low fuel areas. If unsuccessful, and after consultation with an Adnyamathanha authorised officer or DEWNR Liaison Officer, alternative strategies may be considered providing the impact can be justified, and cultural and ecological consequences considered. The best available fire prediction should be used before decisions on strategies are taken. DEWNR staff should be consulted during the development of any incident prediction on Co- and DEWNR-managed lands. Fires are not a common occurrence in the northern region of the planning area around Vulkathunha–Gammon Ranges NP and Ediacara CP, and so due to the remoteness from fire suppression equipment, a ‘watch and wait’ strategy is recommended when no threat is posed to human life or property.

The Adnyamathanha community consider the use of fire suppression chemicals to pose an unacceptable risk to Yura Muda. Of specific concern is the potential for such chemicals to contaminate food sources and Awi Urtu. Where possible, the use of fire suppression chemicals within Vulkathunha–Gammon Ranges NP, Ikara–Flinders Ranges NP, and Ediacara CP is to be avoided.

In all reserves across the planning area the following recommendations are made.

- Cultural heritage sites shall be protected from disturbance, and firefighting vehicles and equipment excluded from specific areas, as advised by the Adnyamathanha authorised officer and/or DEWNR Liaison Officer.
- During appropriate weather conditions and depending on the location, a fire may be left to burn out ('watch and wait') if it does not pose significant threat and the risk and forecast conditions are acceptable.
- Where possible, the use of chemicals should be limited to instances where bushfire is considered a threat to life and property. Chemical use is restricted to those chemicals qualified and approved by the United States Department of Agriculture (USDA) Forest Service and endorsed by the Australasian Fire and Emergency Services Authorities Council (see USDA Forest Service (2008) document).

- Minimum Impact Suppression Techniques and specialised equipment that reduces impacts to the landscape shall be used wherever possible. The impact of the bushfire control methods will not cause greater impact than the potential or actual impact of the bushfire.
- Implement precautionary hygiene measures to reduce the spread of weeds. Weed hygiene measures may incorporate cleaning by water (wash-down), solvent-based cleaning, and/or air jets.

6.2.1 Ground Crews

The following hazards have been identified within the reserves:

- steep terrain, rocky cliffs, and gorges
- the active Dunbar mine and several quarries, covered and uncovered, exist in the Ikara–Flinders Ranges NP. Historical mine shafts are present in Ediacara CP, Ikara–Flinders Ranges, and Vulkathunha–Gammon Ranges NP, some are covered over, but most are not
- several disused wells, covered and uncovered, within Ikara–Flinders Ranges NP and Vulkathunha–Gammon Ranges NP
- thickly vegetated areas with minimal opportunity to escape in the event of a fire
- fuel tanks (Wilpena Visitor Centre, Wilpena Airstrip, Oraparinna Workshop, Virlkundhunha (Balcanoona) Workshop)
- gas bottles (residential housing at Virlkundhunha, Wilpena Visitor Centre, adjacent sewerage evaporation pond at Wilpena and adjoining residential housing within Ikara–Flinders Ranges NP at Oraparinna and Wilpena)
- chemical sheds at Wilpena and Oraparinna workshops
- remote locality of Vulkathunha–Gammon Ranges NP and Ediacara CP.

In regards to fire access within the planning area:

- public roads and access tracks considered important for fire management have been classified to GAFMWG standards and are shown on the Fire Management and Access map (map 4; [online](#))
- gates providing access to reserves are illustrated on the Fire Management and Access map (map 4; [online](#))
- public roads and access tracks classified as Service Tracks should not be used during fire suppression operations unless approved by the Incident Controller
- through access may not be possible (e.g. Pound Track); maps should be checked carefully to reduce the risk of entrapment.

Water for fire suppression may be sourced from standpipes and static water supplies as shown on the Fire Management and Access map (map 4; [online](#)). Alternatively Bulk Water Carriers may be deployed to the incident. There are no natural water sources or dams to provide firefighting water in the planning area.

Backburning operations should only be implemented in accordance with the *Backburning Procedure* (DEWNR 2015b) at the discretion of the Incident Controller.

Further consideration for ground crew safety is:

- unexpected fire behaviour caused by wind funnelling up east/west drainage lines

- westerly wind changes
- likelihood of spotting and ember attack on assets toward the eastern edge of the planning area
- aerial suppression
- the possibility of falling trees/limbs.

6.2.2 Machinery Use

For the protection of Yura Mudu, fire suppression techniques that result in significant soil disturbance should not be used on Co-managed land.

DEWNR have an obligation to maximise safety for fire suppression activities. For this plan, standards for control lines are in accordance with the *Control Lines Procedure* (DEWNR 2015b). Under the advice of the Adnyamathanha authorised officer or DEWNR Liaison Officer, where the combination of vegetation, fuel loads, and terrain is likely to reduce the effectiveness of control lines, they may be widened using techniques that will have the least effect on soil disturbance, such as backburning. For other included lands, chaining or rolling are options that can be utilised. This is to minimise the likelihood of bushfires crossing control lines.

By utilising control lines and through the strategic use of previous fire scars and fuel patterns, the need to undertake other high impact suppression measures, such as chaining or constructing mineral earth breaks during a bushfire, will be reduced. In some situations, it may be more appropriate for control lines to be constructed in neighbouring lands off-reserve, and this will be negotiated with neighbours and the CFS on a case-by-case basis.

The decision to deploy machinery for direct attack should be made by the Incident Management Team (IMT), at the earliest point in time, in consultation with the Adnyamathanha authorised officer and/or DEWNR Liaison Officer, or the relevant landholder/s given:

- cultural and environmental impacts have been assessed and machinery is to be excluded from significant areas such as sites of Adnyamathanha cultural heritage, or threatened or reintroduced fauna and flora sites
- the fire weather and associated fire behaviour conditions under which the machinery will be operating
- the response time and anticipated time of work commencement is acceptable (e.g. to minimise the overall area cleared in the establishment of control lines and increase the likelihood of success)
- steep terrain/cliffs will often considerably reduce the effectiveness of, and pose risks to, machinery operators.

Machinery use and deployment during fire suppression is to be in accordance with:

- the *Protection of Cultural Heritage Procedure* (DEWNR 2015b), *Earthmoving Equipment Procedure* (DEWNR 2015b), and the *CFS Supervision of Machinery Guidelines* (CFS 2007).

6.2.3 Aerial Suppression

There are limited opportunities for aerial fire suppression operations within the Northern Flinders Ranges planning area due to both limited available water and suitable airstrips. There are five main airstrips in the region available for use:

- Hawker; CFS approved bitumen airstrip, but the lack of quality water is a limiting factor. Distance to the reserves is likely to impact response time and effectiveness
- Rawnsley Park Station; the length of the landing strip is no longer suitable for current water bombers. Appropriate for aerial observation and other related tasks
- Wilpena; suitable for light aircraft, but not water bombers. Bituminised helipad and fuel also present
- Ora strip (between Oraparinna and Wilpena); this airstrip can cater for water bombers, but does not have a permanent water supply
- Virlkundhunha (Balcanoona) (3 km from Vulkathunha—Gammon Ranges NP headquarters); bituminised airstrip that caters for light aircraft and helicopters.

Due to its potential effect on Yura Muda, the use of retardant, foam, and dye should be limited to critical situations, such as the protection of built assets, both on and off reserve. The dye added to retardants to make it easy for pilots to identify previous drops could cause damage to cultural assets such as petroglyphs or ochre artwork, and the weight of the water may disturb the soil surface.

Having regard to the above, aerial suppression techniques will be used where appropriate and when conditions permit. This includes the use of water bombers to lessen the intensity of a fire as it reaches a control line, assets, or where supported by ground crews. Bombers that are not supported by ground crews are generally ineffective once a fire is established. This is because bombers are unable to completely extinguish a fire in one drop, and the short period of time it takes for fuels to dry out and reignite.

Aerial ignition may be used for prescribed burning. During bushfires, aerial ignition may be used for backburning to reduce the impact of head fires on control lines.

In all aerial suppression operations across the planning area:

- where possible, the use of retardant, dye, and foam within the planning area should be limited to critical situations to protect Yura Muda. Use of these chemicals should be in accordance with the *Fire Suppression Chemicals Procedure* (DEWNR 2015b)
- implementation of aerial suppression is to be in accordance with the *Aerial Operations Procedure* (DEWNR 2015b) and the CFS Operations Tri-Manual (CFS 2015b)
- ideally, aerial suppression should only be undertaken where the operation is supported by ground crew.

6.3 Visitor Management during Bushfire

The safety of residents and lessees within reserves is managed in accordance with the CFS Be Bushfire Ready principle, which advocates for the preparation of Bushfire Survival Plans ahead of time and explains the shared responsibility of individuals to stay well informed to assist in decision making to improve safety (CFS 2015a).

Visitors within reserves are managed according to the *Visitor Safety Procedure* (DEWNR 2015b) and the *Reserve Closures Procedure* (DEWNR 2015b), which allows for the temporary closure of reserves or cancellation of activities due to an actual emergency, imminent threat, or extreme threat of a bushfire.

Directed evacuation will only be undertaken by the South Australia Police when it is safe to do so, adequate resources are available, and it is evident that loss of life or injury is imminent

and almost certain. DEWNR will comply with all requests from these authorities in evacuations during an emergency.

To ensure safety, DEWNR staff, contractors, and volunteers working within the reserves during the fire season are required to comply with the *Remote and/or Isolated Work Policy* (DEWNR 2006).

7 RECOVERY, RESEARCH AND MONITORING

7.1 Post-fire Rehabilitation and Recovery

The Post-fire Rehabilitation Procedure (DEWNR 2015b) ensures that requirements for the rehabilitation and recovery of areas affected by fire are identified by DEWNR during an incident. A post-fire rehabilitation plan shall consider:

- impacts to infrastructure, built assets, and natural and cultural heritage
- potential threats to biodiversity conservation, cultural and natural heritage, and catchment protection
- actions, responsibilities, and costs associated with the rehabilitation effort.

Specific objectives of post-fire rehabilitation plans are outlined in the procedure.

Under the *Emergency Management Act 2004*, the State Emergency Management Plan for South Australia outlines the process for recovery of incidents and disasters. The State Recovery Office is responsible for major post-bushfire recovery. South Australia is divided into Emergency Management Zones, and each zone is managed by a Zone Emergency Management Committee that is responsible for planning and implementing zone-level actions in support of the State Emergency Management Plan (South Australian Fire and Emergency Services Commission 2015). The Northern Flinders Ranges Fire Management Plan is found within the Far North Zone.

7.2 Research

Any fire-related research that is proposed within the reserves in the planning area should be discussed with the Senior Fire Ecologist and the Adaptive Management Fire Management Officer, be in accordance with the Research Procedure (DEWNR 2015b), and in consultation with the South Australian Arid Lands Region. DEWNR has prepared a *Science Directions* document (DENR 2010c) that outlines some key questions for research in fire science and fire management.

There are currently no regional research or monitoring projects that are targeted at fire impact and response in the planning area. Any proposed environmental burns will need to incorporate impact assessment and response monitoring into the planning.

Monitoring and assessment projects under review are targeted to low fire risk areas with the exception of baseline surveys for Short-tailed Grasswrens (Carpenter 2004) and some of the habitat monitoring associated with a project called Bush-Birds monitoring (DEH 2006a).

The following table summarises recommended research that may be undertaken in the planning area.

Management Strategies

Research

- 55.** Continue to collect and collate vital attributes and life history characteristics for flora and incorporate into future EFMG.
- 56.** Develop and assess KFRS which are appropriate as community-wide indicators of inappropriate fire regimes in the plan area.
- 57.** Investigate the effect of fire on Spinifex Hummock Grasslands and sheltered moist gullies that afford protection to fire sensitive species in fire prone communities.
- 58.** Investigate the use of fire for the management of weeds (e.g. Buffel Grass).

7.3 Monitoring

Monitoring will be established in conjunction with prescribed burns to assess issues raised during prescribed burn planning, in accordance with DEWNR policy and procedures. Implementation will depend upon state and regional priorities and available resources. This includes the *Prescribed Burning Procedure* (DEWNR 2015b) and the *Ecological Burning Procedure* (DEWNR 2015b).

Opportunities for monitoring will also be considered in areas impacted by fire to improve knowledge about the response of species, communities, and habitats to fire within the planning area, as per DEWNR policy (DEWNR 2015b). Research outcomes from other locations, both within South Australia and nationally, will be applied where appropriate to this planning area. The results from pre- and post-fire monitoring will be used to further refine fire management, consistent with an adaptive management approach. Refer to Section 5.3.3 of this plan for general information on zoning, burning, and the planning requirements.

The following table outlines the monitoring recommendations for the planning area.

Management Strategies

Monitoring

- 59.** Strategically monitor flora and fauna species pre- and post-fire to determine their fire response, including long-term monitoring (i.e. 20 years and greater) to establish time to maturity for key fire response species to inform Thresholds of Potential Concern.
- 60.** Monitor the effect of fire on Vinba encroachment on Spinifex Hummock Grasslands.
- 61.** Assess the impact of fire on threatened species e.g. Andu, Idnya, Short-tailed Grasswrens, Slender Bell-fruit (particularly in relation to regeneration and germination).

8 SUMMARY OF MANAGEMENT STRATEGIES

Visitor Use

1. Campsites and other relevant areas to be closed on days of heightened fire danger as per DEWNR park closure policy.
2. Wilpena Pound Resort, in conjunction with the CFS, to prepare a Bushfire Survival Plan for visitor facilities as required and review annually.
3. Implement appropriate fuel management strategies for asset protection and visitor safety (refer to Fire Management and Access map (map 4; [online](#))).
4. DEWNR to provide appropriate bushfire education and information to visitors.

Built Assets

5. Implement fuel management strategies for asset protection consistent with the fire management zoning shown on the Fire Management and Access map (map 4; [online](#)) and other risk mitigation works as detailed in Appendix 1.
6. Encourage the Outback Bushfire Management Committee to liaise with property owners to implement appropriate and coordinated fire management works to minimise the threat of bushfire across the landscape.
7. Encourage volunteer participation in undertaking approved fuel reduction activities on public lands, such as weed spraying and removal.
8. Ensure all major built assets are identified in Response Plans.
9. Identify and inform Incident Action Planning / Response Planning of significant hazards within the planning area (including Oraparinna asbestos mine and Oraparinna explosives store).

Cultural Heritage

10. Implement fuel management strategies appropriate for the protection of assets of cultural heritage significance as shown on Fire Management and Access map (map 4; [online](#)).
11. During bushfire response, assign an Adnyamathanha authorised officer or DEWNR Liaison Officer as primary contact to identify significant cultural assets for protection.
12. During bushfire response, consult the cultural sites register to minimise impacts on significant cultural assets.
13. Identify significant natural water sources and catchments for exclusion of fire suppression chemicals to inform the Incident Action Plan / Response Plan.
14. Adnyamathanha authorised officer and Adnyamathanha Traditional Lands Association to be consulted when planning prescribed burns for reserves.
15. Integrate traditional knowledge about fire management with contemporary scientific principles and technology to develop best practice for the region.
16. Prior to a prescribed burn or during a bushfire, and before any earthworks are undertaken, appropriate consultation is undertaken to identify cultural sites. After a fire, evaluate sites to establish if any damage has occurred and include remediation works in post-fire works plans.

Andu

17. Adopt and implement fire management actions as identified in the Ecological Fire Management Strategy to minimise the risk of local extinctions of Andu.

18. Strategic fire access tracks should be maintained in the vicinity of and between local Andu populations to the current Government Agencies Fire Management Working Group standards to provide access for firefighters, and to contain fire.
19. Any prescribed burning conducted near Andu habitat will be planned in conjunction with the Bounceback Program.
20. Where possible, bushfires should be restricted from burning the entire home range of an Andu colony or population.

Short-tailed Grasswren

21. Develop and implement an Ecological Fire Management Strategy for the Short-tailed Grasswren.
22. During a bushfire, attempt to retain unburnt patches of known Short-tailed Grasswren habitat as refuge areas to minimise the risk of local extinctions.
23. Monitor the effect of fire on Short-tailed Grasswren populations and preferred habitat and use this information in future fire management.
24. Consider patch burning areas of known Short-tailed Grasswren habitat to provide opportunities for colonisation of adjacent areas.
25. Continue and extend the fox baiting program in Short-tailed Grasswren habitat.

Brown Toadlet

26. Exclude prescribed burning from creek edges of known Brown Toadlet habitat.
27. Where possible, avoid the use of fire suppression chemicals in known Brown Toadlet catchment areas.
28. If research opportunities arise with prescribed burns, some pre- and post-surveys are recommended to gather more information to inform the DEWNR fauna vital attribute database for use in Ecological Fire Management Guidelines (Appendix 3).

Flinders Ranges Purple-spotted Gudgeon

29. Develop and implement an Ecological Fire Management Strategy for the Flinders Ranges Purple-spotted Gudgeon.
30. Ensure catchment areas supporting Flinders Ranges Purple-spotted Gudgeons are excluded from prescribed burns.
31. Avoid the use of fire suppression chemicals in known Flinders Ranges Purple-spotted Gudgeon catchment areas.
32. Avoid ash from entering waterways known to support the Flinders Ranges Purple-spotted Gudgeon by establishing sediment traps.
33. Liaise with SARDI to rescue, store, and manage fire-affected Flinders Ranges Purple-spotted Gudgeon populations.

Reintroduced Fauna

34. Exclude prescribed burning, and where possible, bushfire from known habitat for reintroduced species until the success of the reintroductions has been confirmed.
35. Once successfully reintroduced, any prescribed burning conducted near Idnya and Virlda habitat will be planned in conjunction with the Bounceback Program.
36. Use information from the reintroduction project about critical habitat information to inform future fire management planning.

Spinifex Hummock Grassland

- 37. Maintain vegetation in a range of life-stage cohorts to support fauna, particularly the Short-tailed Grasswren.
- 38. Consider small-scale burns to areas of dense Vinba clusters where encroachment on Spinifex Hummock Grassland is threatening to alter its structure, and reduce habitat.

Buffel Grass

- 39. Consider the use of fire as a tool that forms part of an integrated Buffel Grass management strategy.
- 40. Ensure hygiene practices are implemented post-fire to prevent Buffel Grass spread.
- 41. Conduct regular monitoring to detect the establishment of Buffel Grass.
- 42. Consider the likely post-fire response of Buffel Grass and implement post-fire weed control and monitoring.
- 43. Investigate the role of fire in Buffel Grass seed dispersal.

Abundant and Pest Species Management

- 44. Consider the use of fire as a tool that forms part of integrated pest management strategies.
- 45. Consider the likely post-fire responses and impacts of weed species and implement post-fire weed control and monitoring.
- 46. Collect relevant information during prescribed burn planning on abundant and pest species, and undertake a risk assessment to determine the need for post-fire management.
- 47. Adhere to the Standard Operating Procedure – Phytophthora Threat Management (SOP-002) (DEH 2002a).
- 48. Ensure hygiene practices are implemented to reduce the spread of weeds and Phytophthora across the planning area. Refer to the DEWNR Operating Procedure – Phytophthora Vehicle Disinfection Unit (DEH 2003).

Vurndu

- 49. When available, assess vurndu modelling projections from the Bureau of Meteorology, and information from the Environmental Protection Agency (EPA) to consider vurndu management prior to burning operations.

Changing Climate

- 50. Support research of species and ecosystems to inform future fire management strategies in a changing climate.
- 51. Review and adapt fire management strategies in the plan area as the impacts of climate change become understood.
- 52. Monitor national and international fire management policy and best practice, and partner with the research sector to increase our knowledge of altered fire regimes.

Fire Access Tracks

- 53. Maintain all fire access tracks to the current GAFMWG standards as shown on the Fire Management and Access map (map 4; [online](#)).
- 54. Install signs on fire access tracks and gates according to GAFMWG standards and name tracks as appropriate.

Research

55. Continue to collect and collate vital attributes and life history characteristics for flora and incorporate into future EFMG.
56. Develop and assess KFRS which are appropriate as community-wide indicators of inappropriate fire regimes in the plan area.
57. Investigate the effect of fire on Spinifex Hummock Grasslands and sheltered moist gullies that afford protection to fire sensitive species in fire prone communities.
58. Investigate the use of fire for the management of weeds (e.g. Buffel Grass).

Monitoring

59. Strategically monitor flora and fauna species pre- and post-fire to determine their fire response, including long-term monitoring (i.e. 20 years and greater) to establish time to maturity for key fire response species to inform Thresholds of Potential Concern.
60. Monitor the effect of fire on Vinba encroachment on Spinifex Hummock Grasslands.
61. Assess the impact of fire on threatened species e.g. Andu, Idnya, Short-tailed Grasswrens, Slender Bell-fruit (particularly in relation to regeneration and germination).

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10 APPENDICES

Appendix 1 – Assets and Strategies for Risk Mitigation

	Values and Assets	Location	Recommended Actions
Aroona Block	Walking trails Water bore and spring	Ikara—Flinders Ranges NP	<ul style="list-style-type: none"> DEWNR to provide appropriate education and inform of the fire risk to visitors walking the Heysen, Aroona to Youngoona, and Mawson-Springgina Trails, the Yulana Loop and Trezona Loop Walks, and the Yuluna Hike Implement A-zone (minimum 40 m) and B-zone (minimum 100 m) surrounding Brachina East, Youngoona, Trezona, and Koolman Campgrounds, Aroona Homestead, and Koolaman Spring. Implement B-zones (minimum 100 m) surrounding Aroona Spring, Trezona and Dedmans Bore, and Aroona Valley Lookout
Bunkers Block	Yellow-footed Rock-wallaby Preservation Association	Bunkers CR	<ul style="list-style-type: none"> DEWNR to work together with YFRW Preservation Association to develop and implement fuel hazard reduction and associated B-zones for YFRW assets, and Telstra GRN and UHF repeater tower Recommend to the Bushfire Management Committee that fuel reduction works are carried out, particularly on boundaries and surrounding built assets
Ediacara Block	Highly sensitive fossil deposits	Ediacara CP	<ul style="list-style-type: none"> Undertake comprehensive briefing of crews prior to deployment Update Response Plans to identify 'no go' zones to reduce the risk of damage to Ediacaran fossils
Ikara Block	Adjacent grazing land	Ikara—Flinders Ranges NP	<ul style="list-style-type: none"> Recommend to the Bushfire Management Committee that fuel reduction works are carried out on adjacent private grazing land (particularly near built assets) Implement A-zone (minimum 40 m) and B-zone (minimum 100 m) surrounding Hills Homestead and Wangarra Lookout Implement B-zones (minimum 100 m) surrounding Cooinda Camp, and Pound Tracks, and Bridle Gap Trail (Heysen Trail)

	Values and Assets	Location	Recommended Actions
Illaworringa Block	<p>Heritage accommodation and campgrounds Water points and tanks Adjacent grazing land Adjacent Arkurra (Arkaroola) Village Adjacent airstrip and hangars</p>	Vulkathunha-Gammon Ranges NP	<ul style="list-style-type: none"> Implement A-zones (minimum 40 m) and B-zones (minimum 100 m) surrounding Nudlamutana Hut, and Main Water Well, Idnhinha, and Grindells campgrounds Implement a B-zone (minimum 100 m) surrounding Bolla Bollana Smelter Maintain regular fuel reduction surrounding water points and tanks to B-zone standard (minimum 40 m) to protect water sources during a bushfire Recommend to the Bushfire Management Committee that fuel reduction works are carried out on private grazing land (particularly near built assets), and surrounding the airstrip and hangars (including A- and B-zones) Recommend to the Bushfire Management Committee that fuel reduction works are carried out on adjacent private property (particularly near built assets)
Ithala Awi Block	<p>Adjacent Nipapaha (Nepubunna) Community Nantawarrina Indigenous Protected Area Non-Aboriginal heritage</p>	Vulkathunha – Gammon Ranges NP	<ul style="list-style-type: none"> Assist the Bushfire Management Committee and the Nipapaha Community to implement fire prevention works Work with the Bushfire Management Committee to inform and involve the community of fire prevention works Implement A-zones of 40 m surrounding non-Aboriginal heritage

	Values and Assets	Location	Recommended Actions
McKinlay Block	<p>Heritage accommodation and campgrounds Water points and tanks Adjacent grazing land Walking trail</p>	Vulkathunha – Gammon Ranges NP	<ul style="list-style-type: none"> • Implement A-zones (minimum 40 m) and B-zones (minimum 100 m) surrounding Grindells Hut, and Loch Ness Well, Adkunha Vambata (Arcoona), Ithala Awi (Italowie), and Wiriti Urdla (Weetootla) campgrounds • Implement a B-zone (minimum 100 m) surrounding Ukapudunha (Oocaboollina) Outstation • Maintain regular fuel reduction surrounding water points and tanks to B-zone standard (minimum 40 m) to protect water sources during a bushfire • Recommend to the Bushfire Management Committee that fuel reduction works are carried out on private grazing land (particularly near built assets) • DEWNR to provide appropriate fire risk education and information to visitors walking the Wiriti Urdla Trail

	Values and Assets	Location	Recommended Actions
Oraparinna Block	<p>Short-tailed Grasswren, Amytornis merrotsyi Rock carving Non-aboriginal heritage Airstrip Water bore Lookout Campgrounds Adjacent grazing land</p>	Ikara—Flinders Ranges NP	<ul style="list-style-type: none"> Implement C-zone ecological prescribed burns where Vinba is encroaching on Spinifex Hummock Grassland Implement patchy C-zone ecological prescribed burns within the Spinifex Hummock Grassland, to create long-term habitat for the Short-tailed Grasswren In consultation with the Ikara—Flinders Ranges Co-management Board, and Hawker and Wilpena CFS brigades, implement management actions to protect the Perawurtina rock carving site from the effects of fire Implement A-zones (minimum 40 m) and B-zones (minimum 100 m) surrounding Cambrian, Acraman, and Dingley Dell Campgrounds, and huts along Yanyanna Track Implement B-zones (minimum 100 m) surrounding the stone buildings and miners dugout at Appealinna heritage site, Highways Camp, Lubra Waterhole Lookout, and Prices Bore Implement a B-zone (minimum 700 m) surrounding Oraparinna airstrip to reduce the likelihood of bushfire affecting the adjacent Willow Springs property, and the Oraparinna airstrip Recommend to Bushfire Management Committee that fuel reduction works are carried out on private grazing land (particularly near built assets) Recommend that the Dunbar Mine leaseholder implement appropriate fire management works, e.g. fuel reduction, along Blinman Road and adjacent the mine site DEWNR to provide appropriate education and inform of the fire risk to visitors using the Heysen and Mawson Trails, and Yanyanna Walk

	Values and Assets	Location	Recommended Actions
Pantapinna Block	Walking trail Campground Bounceback Program revegetation and monitoring sites	Ikara—Flinders Ranges NP	<ul style="list-style-type: none"> DEWNR to provide appropriate fire risk education and information to walkers on the Wilkawillina trail Implement an A-zone (minimum 40 m) and a B-zone (minimum 100 m) surrounding Dingley Dell Campground Implement a B-zone (minimum 100 m) surrounding Guide Hut Consultation with Bounceback Program Officers prior to prescribed burns to ensure impacts to reintroduced species and revegetation sites are minimised, that burn locations are appropriate, and sites are identified in the Response Plan
Rawnsley Block	Rawnseley Park Station Highway	Heritage Agreement 1353 and unalienated Crown land	<ul style="list-style-type: none"> Through the Bushfire Management Committee, encourage neighbours to develop a Bushfire Survival Plan Through the Bushfire Management Committee, encourage neighbours to develop and maintain liaison with CFS Through the Bushfire Management Committee, encourage neighbours to prevent human initiated bushfires Assist Heritage Agreement owners to identify, prioritise and protect revegetation sites Implement fuel reduction activities (such as slashing) along Flinders Ranges Way to reduce the risk of a bushfire impacting industry and commerce that depend upon the use of this road.
Resort Block	Resort accommodation Visitor Centre Major infrastructure	Ikara—Flinders Ranges National Park	<ul style="list-style-type: none"> Implement A-zones (minimum 40 m) and B-zones (minimum 100 m) surrounding the Wilpena Pound Resort, campground, visitor centre, Old Wilpena Station, outbuildings and shearing shed, and power station Implement B-zones (minimum 100 m) surrounding Hawker-Wilpena Road, and the unsealed roads to the power station and airstrip Ensure lease obligations are adhered to, to protect staff and visitors of the Wilpena Pound Resort lease area Create a graded fire break surrounding Wilpena Pound Resort and maintain annually

	Values and Assets	Location	Recommended Actions
Plains Block	Pipeline Airstrip Water points and tanks Dingo fence Adjacent grazing land	Vulkathunha – Gammon Ranges NP	<ul style="list-style-type: none"> Recommend to service provider that appropriate protection measures are ensured for Moomba Pipeline Implement a B-zone (minimum 100 m) surrounding the airstrip Maintain regular fuel reduction surrounding water points and tanks to B-zone standard (minimum 40 m) to protect water sources during a bushfire Encourage the Dog Fence Board to enact fuel reduction along their assets and easements Recommend to the Bushfire Management Committee that fuel reduction works are carried out on private grazing land (particularly near built assets)
Virkundhunha Block	Heritage accommodation	Vulkathunha – Gammon Ranges NP	<ul style="list-style-type: none"> Maintain regular fuel reduction within 200 m of Balcanoona Homestead, shearing shed, and outbuildings e.g. slashing, brush cutting Implement A-zone (minimum 40 m) and B-zone (minimum 100 m) surrounding Balcanoona Homestead Install 45,000 litre water tank at Virkundhunha (Balcanoona) for use in fire suppression
Wilpena Block	Major infrastructure	Ikara–Flinders Ranges NP	<ul style="list-style-type: none"> Implement an A-zone (minimum 40 m) and a B-zone (minimum 100 m) surrounding the telephone exchange Implement B-zones (minimum 100 m) surrounding the Telegraph Track, Wood Duck Dam, Jones Camp ruins, and Cazneaux Tree day visitor area Ensure lease obligations are adhered to in regards to legislated fire requirements

Appendix 2 – Fire Response of Rated, Significant and Introduced Flora Species

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
Acacia araneosa	Spidery Wattle	VU	E	VU	V		Tree	<ul style="list-style-type: none"> Restricted to a small geological band less than 15 km long where it grows in calcareous soil on hillsides and ridges Flowers produced irregularly, usually following significant rainfall Fire response is unknown but in association with highly flammable Triodia Hummock Grass 	<ul style="list-style-type: none"> Whole population unlikely to be burnt in one event except following an exceptional succession of years that promote dense spear grass cover as occurred following 2010 -11 Research involving burning to investigate fire response is recommended to inform future management needs 	SAN AusV
Acacia menzelii	Menzel's Wattle	VU	V	VU	F		Shrub	<ul style="list-style-type: none"> Grows on soil types ranging from loams to sandy loams Flowering: July to October Fire response is unknown 		SAN AusV
Acacia trineura	Three-nerve Wattle		E		F		Shrub	<ul style="list-style-type: none"> Grows in mallee communities Flowering: August to October Fire response is unknown 		AusV
Acetosa vesicaria*	Wild Hops				F V		Annual herb	<ul style="list-style-type: none"> Flowering: winter to early summer Reaches reproductive maturity within a year Germinates from seed post-fire 		AusV

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Asphodelus fistulosus</i> *	Onion Weed				BF V		Annual herb	<ul style="list-style-type: none"> Prefers disturbed and overgrazed sites Flowering: late winter to spring Plant spreads by seed, which can germinate at any time of the year Variable fire response observed, resprouting and post-fire seed recruitment based on moisture and fire intensity 		SA^ Aus^
<i>Atriplex kochiana</i>	Koch's Saltbush	V	VU	V			Shrub	<ul style="list-style-type: none"> Short-lived saltbush that can regenerate from seed following summer rains Congeners killed by fire 	<ul style="list-style-type: none"> Where possible, planned fire should be excluded from this species' habitat 	Aus
<i>Austrostipa pilata</i>	Prickly Spear-grass	V	LC	V			Perennial grass	<ul style="list-style-type: none"> Occurs in mallee on rocky slopes Flowering: October to November Fire response is unknown 	<ul style="list-style-type: none"> Avoid inter-fire intervals < 10 years 	SA^
<i>Caladenia flaccida</i>	Drooping Spider-orchid	V		F			Orchid	<ul style="list-style-type: none"> Occurs in woodland and low scrub Flowering: August to September Fire response is unknown 		SA^
<i>Carrichtera annua</i> *	Ward's Weed				F V		Annual herb	<ul style="list-style-type: none"> Largely restricted to areas of winter dominated rainfall and calcareous soils Flowering: spring Post-fire seed recruitment 		Aus^

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Cenchrus ciliaris</i> *	Buffel Grass				B F V		Perennial grass	<ul style="list-style-type: none"> Occurs in a variety of soil types, preferring red earth soils Flowering: summer to autumn Can significantly increase fuel loads and therefore increase fire severity, frequency and extent, which in turn impacts negatively on many native species, particularly overstorey species Increases relative abundance post-fire 	<ul style="list-style-type: none"> Post-fire weed control likely to be required since burning stimulates mass germination of the seed bank 	SA & AUS*
<i>Cylindropuntia fulgida</i> var. <i>mamillata</i> *	Coral Cactus						Cactus	<ul style="list-style-type: none"> No populations in South Australia are known to fruit or flower. Species apparently spreading through fragmentation 		SA
<i>Cylindropuntia imbricata</i> *	Devil's Rope Cactus						Cactus	<ul style="list-style-type: none"> Flowering: late spring to summer 		SA
<i>Cylindropuntia prolifera</i> *	Jumping Cholla				V		Cactus	<ul style="list-style-type: none"> Flowering: spring to early summer Does not produce seed over its habitat range. 		SA

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Codonocarpus pyramidalis</i>	Slender Bell-fruit	VU	E	RA	B F V		Tree	<ul style="list-style-type: none"> Occurs on a variety of soils on hill slopes, stony rises, and creek beds Grows rapidly, but is short lived Flowering: May to October Post-fire seed recruitment Respond well to fire 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent Species is highly palatable to native and feral herbivores. <p>Protection/management of browsing should be considered post-fire</p>	S A^ AUS^
<i>Dodonaea subglandulifera</i>	Peep Hill Hop Bush	EN	E		V		Shrub	<ul style="list-style-type: none"> Flowering: Dioecious, flowers between February and August Fire response is unknown 		S A^
<i>Doodia caudata</i>	Small Rasp-fern		E	EN	V		Fern	<ul style="list-style-type: none"> Riparian habitat, occurring amongst rocky outcrops and shaded creek banks Recruitment may be from spores or horizontal runners Likely to resprout post-fire 		AUS^
<i>Echium plantagineum*</i>	Salvation Jane				F V		Perennial herb	<ul style="list-style-type: none"> Declared under the SA Natural Resource Management Act 2004 Adults killed by fire Seedlings readily recruit post-fire Some seeds are killed by fire 	<ul style="list-style-type: none"> Weed control may be required post-fire 	S A

Scientific name	Common Name	EPBC status	NPW Act†	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Eucalyptus goniocalyx</i> ssp. <i>exposta</i>	Long-leaf Box	V	VU	F			Tree	<ul style="list-style-type: none"> Occurs on exposed rocky sites on peaks and ridges higher than 900 m Likely to resprout from the base post-fire 		SA Aus^
<i>Histiopteris incisa</i>	Bat's-wing Fern	E	CR	F			Fern	<ul style="list-style-type: none"> Widespread in moist, sheltered positions, where it often forms extensive colonies Variable fire response observed; resprouting and post fire seed recruitment 		Aus^
<i>Lycium ferocissimum</i> *	African Boxthorn				BF V		Shrub	<ul style="list-style-type: none"> Occurs in almost every vegetation type; usually found along watercourses or at watering places Plants can start to flower at two years old and mainly bear fruit in summer, but flowering and fruiting can occur throughout the year Resprouts after fire Seeds are spread by frugivorous animals 	<ul style="list-style-type: none"> African Boxthorn is not thought to be controlled by fire Weed control may be required post fire 	SA^
<i>Maireana excavata</i>	Bottle Fissure-plant	V	VU	F			Shrub	<ul style="list-style-type: none"> Occurs in open grasslands Flowering: spring Congeners killed by fire 	<ul style="list-style-type: none"> Where possible, prescribed burns should be excluded from these species' habitat 	Aus^

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Malacocera gracilis</i>	Slender Soft-horns	V	RA	V			Shrub	<ul style="list-style-type: none"> Occurs on saline clay soils or gypseous mounds Flowering: May to August Congeners killed by fire 	<ul style="list-style-type: none"> Where possible, prescribed burns should be excluded from these species' habitat 	SA
<i>Marrubium vulgare*</i>	Horehound			F V			Shrub	<ul style="list-style-type: none"> Declared under the SA Natural Resource Management Act 2004 Flowering: September to March Adults killed by fire Fire may reduce up to 80% of the seedbank Seedlings readily recruit post-fire 	<ul style="list-style-type: none"> Weed control may be required following fire 	SA ^{AUS}
<i>Peganum harmala*</i>	African Rue			V			Shrub	<ul style="list-style-type: none"> Flowering: Late spring to early summer Response to fire unknown 		
<i>Opuntia engelmannii*</i>	Engelmann's Prickly Pear						Cactus	<ul style="list-style-type: none"> Flowering time unknown 		SA
<i>Opuntia robusta*</i>	Wheel Cactus				F		Cactus	<ul style="list-style-type: none"> Flowering time unknown 		SA

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Opuntia stricta</i> *	Prickly Pear				F		Cactus	<ul style="list-style-type: none"> Flowering: summer 		SA
<i>Ozothamnus scaber</i>	Rough Bush-everlasting	V	VU	V			Shrub	<ul style="list-style-type: none"> Flowering: October to December Response is likely to be a seeder, based on info for closely related species 		SA I
<i>Phyllangium sulcatum</i>	Rock Mitrewort	V	VU	F			Annual herb	<ul style="list-style-type: none"> Occurs on hillslopes in sheltered sites Flowering: September to November Reach productive maturity after one year Fire response is unknown 		SA Aus^
<i>Pycnosorus globosus</i>	Drumsticks	V	VU				Perennial herb	<ul style="list-style-type: none"> Occurs on clay soils in woodland, grassland, and saltbush steppe, forming dense colonies Flowering: October to December Fire response is unknown 		SA Aus^
<i>Ranunculus pumilio</i> var. <i>politus</i>	Smooth-fruit Ferny Buttercup	V	VU	F			Annual Forb	<ul style="list-style-type: none"> Occurs on clay soils Flowering: spring Likely to be a seeder based on info for related species 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent 	SA Aus^ I

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Ranunculus sessiliflorus</i> var. <i>pilulifer</i>	Annual Buttercup	V	EN	F			Annual herb	<ul style="list-style-type: none"> Flowering: spring Likely to be a seeder based on info for related species Observed growing profusely after fire in lower Yorke Peninsula 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent 	SAN Aus
<i>Santalum spicatum</i>	Sandalwood	V	NT	B F V			Small tree	<ul style="list-style-type: none"> Flowers throughout the year but mainly March to June Fire sensitive Seeder 	<ul style="list-style-type: none"> Avoid large hot bushfires Consider strategic protection burns around known stands and host plants Protection/management of browsing should be considered post-fire 	SAN Aus
<i>Schinus molle</i> *	Pepper Tree			B F V			Tree	<ul style="list-style-type: none"> Flowering: throughout the year Low flammability plant Does not regenerate from seed following fire. However, basal and root resprouting can be aggressive following fire Smoke from burning may irritate or cause allergic reactions in individuals since <i>Schinus</i> sp. belongs to the same family as poison oak and ivy 	<ul style="list-style-type: none"> Studies using frequent burns to control the invasiveness of <i>Schinus</i> sp. have shown little to no reduction in the plant's spread 	SAN Aus
<i>Swainsona behriana</i>	Behr's Swainson-pea	V		V			Perennial herb	<ul style="list-style-type: none"> Flowering: July to October Congeners killed by fire Seed germination likely to be stimulated by fire 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent 	SAN Aus

Scientific name	Common Name	EPBC status	NPW Act	Regional status	Reserve	MVS	Life form	Species Ecology & Fire Response	Ecological Fire Management Guidelines	Source
<i>Swainsona sericea</i>	Silky Swainson-pea		E		V		Perennial herb	<ul style="list-style-type: none"> Flowering: July to October Congeners killed by fire Seed germination likely to be stimulated by fire 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent 	SA^ Aus
<i>Swainsona viridis</i>	Creeping Darling Pea		V	VU	V		Annual herb	<ul style="list-style-type: none"> Flowering: August to November Congeners killed by fire Seed germination likely to be stimulated by fire 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent 	SA^ Aus
<i>Tamarix aphylla</i>	Athel Pine				B F V		Tree	<ul style="list-style-type: none"> Flowering: spring Leaves have high moisture content and therefore low flammability. However, dead foliage is highly flammable Plants generally re-sprout following fire, however response can vary depending on time and intensity 	<ul style="list-style-type: none"> Weed control may be required following fire 	Aus^
<i>Thelymitra aristata</i>	Great Sun-orchid		E		F		Orchid	<ul style="list-style-type: none"> Flowering: October to November Re-sprouts after fire Only flowers freely after fire 	<ul style="list-style-type: none"> Fire should be considered to stimulate seedling regeneration if recruitment is poor/absent 	SA^

Appendix 3 – Fire Response of Rated and Significant Fauna Species

Type	Scientific Name	Common Name	EBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Bird	<i>Amytornis merrotsyi</i>	Short-tailed Grasswren			RA	F	I	<ul style="list-style-type: none"> Sites: Spinifex Hummocks Material: domed nest made out of grass Season: unknown 	<ul style="list-style-type: none"> Restricted to rocky hillsides covered in large clumps of Spinifex Short-tailed Grasswrens re-occupy burnt vegetation five to seven years after a fire Peak densities 10-30 years post fire where large Spinifex covers 65% of the ground 	<ul style="list-style-type: none"> Avoid inter-fire intervals <7 years Some inter-fire intervals >20 years desirable 	Aus
Bird	<i>Ardeotis australis</i>	Australian Bustard	V	VU	F V	I C H		<ul style="list-style-type: none"> Site: on bare ground or in grass Material: none Season: August to November 	<ul style="list-style-type: none"> Prefers Tussock Grasslands, however, also inhabits Hummock Grasslands, low shrublands, grassy woodlands and pastoral country Their presence is an indicator of well managed country Respond readily to fire. Often found on recently burnt country 	<ul style="list-style-type: none"> Vulnerable to fire in the nesting season, as they nest on the ground Mosaic of post-fire vegetation is desirable 	Aus

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Bird	<i>Calamanthus cautus</i>	Shy Heathwren	R	EN	F V	I G		<ul style="list-style-type: none"> Site: on the ground in a concealed location Material: domed nest made out of twigs and other vegetation Season: late winter to early summer 	<ul style="list-style-type: none"> Inhabits mallee woodlands with a relatively dense understorey of shrubs and heath plants. Also known to occur in rocky hilltop vegetation with a thick Melaleuca shrub layer Feeds on the ground layer Appears to occur in all age classes of vegetation. Prefer one to five years post-fire, when the re-sprouting eucalypts provide dense vegetation cover. It also prefers long unburnt areas which have a well-developed dense shrub layer 	<ul style="list-style-type: none"> Mosaic of post-fire vegetation is desirable Avoid frequent inter-fire intervals 	Aus
Bird	<i>Northiella haematogaster narethae</i>	Blue Bonnet Western ssp	R	LC	V	H G		<ul style="list-style-type: none"> Sites: nests in tree hollow of Eucalyptus, Acacia and Casuarina Material: grass Season: July-Dec or after rain 	<ul style="list-style-type: none"> Occurs throughout the southern parts of inland Australia Inhabits grassy woodlands, native pine, casuarina, saltbush, and bluebush shrublands Feeds on fruits and seed of bluebush, saltbush and acacia shrubs which are vulnerable to bushfire 	<ul style="list-style-type: none"> Protect known nesting trees and potential nesting areas 	Aus^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Bird	<i>Rostratula australis</i>	Australian Painted Snipe	V	V	F	I	G	<ul style="list-style-type: none"> Sites: shallow wetlands with areas of bare wet mud and canopy cover nearby Material: mud or dry grass Season: recorded breeding all months 	<ul style="list-style-type: none"> Inhabits shallow terrestrial freshwater Burning of fringing vegetation likely to be detrimental as requires rank grasses, sedges, or reeds for shelter and nest sites 	<ul style="list-style-type: none"> Avoid burning around permanent springs 	Aus^
Fish	<i>Mogurnda clivicola</i>	Flinders Ranges Purple-spotted Gudgeon	VU		CR	V		<ul style="list-style-type: none"> Aquatic 	<ul style="list-style-type: none"> Inhabits spring-fed rocky-bottomed streams Water chemistry and quality of streams can be altered by inputs of smoke, ash, and fire retardants. The direct impacts of fire can result in immediate death 	<ul style="list-style-type: none"> Where possible, avoid contaminants entering waterways known to support populations by establishing sediment traps 	Aus

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Mammal	<i>Notomys fuscus</i>	Dusky Hopping-mouse	VU	V	LC	V	H I C	<ul style="list-style-type: none"> Sites: arid areas with sand dunes or sand plains with hummocks Material: burrows with an elaborate series of tunnels and chambers up to one metre deep and five metres long Season: no distinct season, influenced by rainfall 	<ul style="list-style-type: none"> Likely to survive low intensity fire by taking refuge in burrows Extensive fires may increase exposure for predation 	<ul style="list-style-type: none"> Mosaic of post-fire vegetation is desirable 	SA^ Aus^
Mammal	<i>Petrogale xanthopus</i>	Yellow-footed Rock-wallaby	VU	V	RA	B F V	H	<ul style="list-style-type: none"> Sites: rocky outcrops Material: none Season: no distinct season, influenced by rainfall 	<ul style="list-style-type: none"> Live in small groups occupying a particular rock outcrop Have a home range of up to 30 ha Fire can directly kill through radiant heat Fire may result in the loss of vegetation cover, exposing any surviving rock wallabies to predators Fire may affect habitat quality due to changes in vegetation composition 	<ul style="list-style-type: none"> Refer to the Ecological Fire Management Strategy for Yellow-footed Rock-wallaby 	SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Reptiles	<i>Aprasia pseudopulchella</i>	Flinders Worm-lizard	VU		RA	F V	I	<ul style="list-style-type: none"> Site: open and closed woodland, native Tussock Grassland, riparian habitats and rocky isolates Material: burrows in loose sand with vegetation intact litter beds. Also found under rocks, logs, and in termite nests Season: unknown 	<ul style="list-style-type: none"> Diet consists almost entirely of the larvae and pupae of ants Fire response is unknown, however burning reduces litter beneath vegetation which is likely to be important to this species 	<ul style="list-style-type: none"> Aim to provide unburnt areas for refuge to facilitate recolonisation Where possible, avoid the use of foam and retardants in known habitat 	Aus^ SA^

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Amphibians	<i>Crinia flindersensis</i>	Northern Flinders Ranges Froglet			LC	F V	I	<ul style="list-style-type: none"> Sites: in slow moving wetlands/ waterways Material: water Season: winter, however may breed opportunistically 	<ul style="list-style-type: none"> Occurs mostly at springs and creeklines that receive regular sustained annual flows 	<ul style="list-style-type: none"> Where possible, avoid the use of foam and retardants in and surrounding watercourses Sediment traps may be required to minimise the amount of mobilised sediment reaching the watercourse following a bushfire 	SA ^a

Type	Scientific Name	Common Name	EPBC Act Status	NPW Act Status	Regional Rating	Reserve	Diet	Breeding	Species Ecology & Fire Response	Fire Management Considerations	Source
Amphibians	<i>Pseudophryne bibronii</i>	Brown Toadlet	R	EN	I			<ul style="list-style-type: none"> Sites: utilise areas with substantial leaf litter adjacent to creeks receiving regular annual flows and waterholes Material: under leaf litter and grassy debris in moist seepage areas and depressions Season: May to June 	<ul style="list-style-type: none"> Found in woodlands, heathlands, and grasslands 	<ul style="list-style-type: none"> Litter input in subsequent years is greatly reduced by high intensity fires Where possible, avoid the use of foam and retardants in and surrounding watercourses Sediment traps may be required to minimise the amount of mobilised sediment reaching the watercourse following a bushfire 	Aus ¹

Appendix 4 – Ecological Communities of Conservation Significance

Ecological Community	SA Status (DEH 2005b)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Management Guidelines	Source
Red Gum (<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i>) grassy woodland	v (SA)		B F V	<ul style="list-style-type: none"> Over Saltbushes (<i>Rhagodia</i> spp.), Ruby Saltbush (<i>Enchylaena tomentosa</i>), Waterbush (<i>Myoporum montanum</i>), Plum bush (<i>Eremophila lanceolata</i>), Hop-bush (<i>Dodonaea</i> spp.), Wattles (<i>Acacia</i> spp.), Spear-grasses (<i>Austrostipa</i> spp.), Wallaby-grasses (<i>Rytidosperma</i> spp.), and Old Man's Beard (<i>Clematis microphylla</i>) 	<ul style="list-style-type: none"> Red Gum trees are vulnerable to fire, however the impact of fire on individual trees is likely to vary substantially in response to fire intensity, as well as tree age, with juvenile tree stages expected to be more vulnerable The response of understorey species is determined by the component species characteristics Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent Strongly suspected that Buffel Grass fuelled fires are responsible for the decline of Red Gum in arid areas (Marshall, Ostendorf & Lewis 2013) 	<ul style="list-style-type: none"> Avoid burning entire remnants during a single fire event Management of browsing should be considered post-fire and following useful rainfall to enable Red Gum trees and understorey species to regenerate 	SAN

Ecological Community	SA Status (DEH 2005b)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Management Guidelines	Source
Bullock Bush (<i>Alectryon oleifolius</i> ssp. <i>canescens</i>) tall shrubland			B F V	<ul style="list-style-type: none"> Bullock Bush generally appears as scattered trees or in small groups over a hugely variable understorey including Spear-grasses (<i>Austrostipa</i> spp.), Saltbushes (<i>Rhagodia</i> spp.), Saltbushes (<i>Atriplex</i> spp.), and Bluebushes (<i>Maireana</i> spp.) 	<ul style="list-style-type: none"> Where grassy/herbaceous understorey of this community is already moderately to highly degraded, fire may significantly increase weed cover and extent 	<ul style="list-style-type: none"> Excessive grazing contributes to the degradation of this community. Thus post-fire grazing pressure management may be required 	SAA
Flinders Grey Mallee (<i>Eucalyptus flindersii</i>) over shrubland and low open Hummock Grassland			B F V	<ul style="list-style-type: none"> In association with Northern Cypress Pine (<i>Callitris glauophylla</i>) and Gum Barked Coolibah (<i>Eucalyptus intertexta</i>) over Curry Bush (<i>Cassinia laevis</i>), Sticky Hop-bush (<i>Dodonaea viscosa</i>) with Spinifex (<i>Triodia</i> spp.), Silver Mulla Mulla (<i>Ptilotus obovatus</i>), Rock Sida (<i>Sida petrophila</i>), Scented Button-bush (<i>Chrysocephalum semicalvum</i>), and Wooly Cloak-fern (<i>Cheilanthes lasiophylla</i>) This community occupies the high ridgetops and summits, and supports a number of species that are restricted to these cooler, moister environments e.g. Dusty Miller (<i>Spyridium phlebophyllum</i>), Rough Grevillea (<i>Grevillea aspera</i>), Needle Bottlebrush (<i>Callistemon teretifolius</i>), and Striped Mint-bush (<i>Prostanthera striatiflora</i>). All species at risk from Feral Goat herbivory and climate change 	<ul style="list-style-type: none"> Fire may be important for this community, and further investigation into appropriate fire regimes is necessary 	<ul style="list-style-type: none"> Maintain patchiness in burns as this community supports a diverse mix of fire sensitive and responsive species as well as structural diversity Excessive grazing contributes to the degradation of this community. Thus post-fire grazing pressure management may be required 	SAA

Ecological Community	SA Status (DEH 2005b)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Management Guidelines	Source
Gum barked Coolibah (<i>Eucalyptus intertexta</i>) woodland with low shrubland understorey			B F V	<ul style="list-style-type: none"> In association with Northern Cypress Pine (<i>Callitris glaucophylla</i>) and Flinders Grey Mallee (<i>Eucalyptus flindersii</i>) over Curry Bush (<i>Cassinia laevis</i>), Sticky Hop-bush (<i>Dodonaea viscosa</i>) with Spinifex (<i>Triodia</i> spp.), Silver Mulla Mulla (<i>Ptilotus obovatus</i>), Rock Sida (<i>Sida petrophila</i>), Scented Button-bush (<i>Chrysocephalum semicalvum</i>), and Wooly Cloak-fern (<i>Cheilanthes lasiophylla</i>) 	<ul style="list-style-type: none"> Fire may be important for this community, and further investigation into appropriate fire regimes is necessary 	<ul style="list-style-type: none"> Post-fire grazing pressure management may be required 	SA^
Drooping Sheoak (<i>Allocasuarina verticillata</i>) woodland over low sparse sedgeland			B F V	<ul style="list-style-type: none"> Grows in association with Flinders Grey Mallee (<i>Eucalyptus flindersii</i>) over shrubs, usually on the steeper and cooler south to east facing slope of the high ranges, with densest large stands within Ikara 	<ul style="list-style-type: none"> High frequency and intense fires results in a decline in mature Drooping Sheoak Grazing pressure by herbivores, post-fire can affect recruitment of Drooping Sheoak 	<ul style="list-style-type: none"> Avoid burning contiguous remnants of Drooping Sheoak Woodland in their entirety during a single fire event, instead aim to increase patchiness within the remnants Determine the response of the community to different disturbance regimes through the application of ecological/experimental burns Post-fire grazing pressure management may be required 	SA^

Ecological Community	SA Status (DEH 2005b)	Other Status comments	Occurrence	Components	Fire Response	Ecological Fire Management Guidelines	Source
Spinifex (<i>Triodia</i> spp.) Hummock Grassland			B F	<ul style="list-style-type: none"> Hummock Grasses (<i>Triodia</i> sp.), over sparse grasses and forbs, Lemon Grass (<i>Cymbopogon ambiguus</i>), Balcarra Spear-grass (<i>Austrostipa nitida</i>), (<i>Ptilotus obovatus</i>), (<i>Solanum ellipticum/quadriloculatum</i>), Woolly Cloak-fern (<i>Cheilanthes lasiophylla</i>), and Narrow Rock-fern (<i>Cheilanthes sieberi</i> ssp. <i>sieberi</i>) It is mostly confined to steep, rocky sites with very poor skeletal soils, and a large proportion of bare ground is usually evident between hummocks 	<ul style="list-style-type: none"> Spinifex resprouts after fire Fire history is a critical influence of Spinifex survival, distribution, and growth in the mallee and Spinifex landscapes. Spinifex rejuvenates from rootstock following fire. However, the growth and structure of Spinifex plants varies according to Spinifex species, rainfall, drainage, soil type, and plant age. At approximately 20 years post fire Spinifex starts to become sparse and open, due to competition for light as it can be shaded by mallee and shrubs 	<ul style="list-style-type: none"> The Short-tailed Grasswren (<i>Amytornis merrotsyi</i>) is endemic to the Flinders Ranges, and is associated with Spinifex Hummock Grass with or without overstorey. In the Flinders Ranges, the Short-tailed Grasswren has been recorded in the north-eastern Flinders Ranges. All sites where this species has been recorded are characterised by a dense cover of Spinifex with a shrub, mallee, or low woodland overstorey 	SA1

Summary of Codes Used in Appendices

Reserve Codes

CODE	RESERVE	CODE	RESERVE
B	Bunkers Private Conservation Reserve	F	Ikara—Flinders Ranges National Park
E	Ediacara Conservation Park	V	Vulkathunha—Gammon Ranges National Park

Other Codes Used

NPW ACT STATUS		EPBC ACT STATUS		REGIONAL RATING		DIET OF RATED FAUNA SPECIES	
E	Endangered	EX	Extinct	CR	Critically Endangered	C	Carnivore or scavenger. Mainly vertebrates
V	Vulnerable	CE	Critically Endangered	EN	Endangered	H	Herbivore. Includes folivores, grazers & browsers
R	Rare	EN	Endangered	Vu	Vulnerable	N	Nectar feeder
		VU	Vulnerable	RA	Rare	I	Insectivore/arthropodivore /omnivore
				NT	Near threatened	G	Granivore. Typically peak in abundance after a fire event in fire adapted vegetation, due to the stimulation of flowering and subsequent seed set
				LC	Least Concern		

MISCELLANEOUS CODES

*	Introduced species
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FIRE RESPONSE SOURCE

R	Regional or local data
SA	South Australian data
Aus	Interstate data
A	Data/observations derived from published or unpublished literature
E	Expert opinion
I	Inferred from similar species (Senior Fire Ecologist, Fire Management Unit, has inferred based on other species genera)

11 GLOSSARY OF ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY

TERM	DEFINITION
Adnyamathanha authorised officer	A person who is authorised under the Aboriginal Heritage Act 1988 to protect Adnyamathanha values.
Australasian Inter-service Incident Management System	A system for the management of all incidents, imminent or actual, occurring in the natural or built environment; or for the many other activities that emergency management agencies, and those that support them, may have to deal with.
Backburn	A fire started intentionally along the inner edge of a control line to consume the fuel in the path of a bushfire.
Bark Fuel	The flammable bark on tree trunks and upper branches (DENR 2011b).
Biodiversity	Biological diversity. The diversity of life in all its forms (i.e. plants, animals, and micro-organisms) and at all its levels of organisation (i.e. genetic, species and ecosystem levels).
Block	Used to describe an area of the landscape defined during fire management planning, based on similar characteristics and management requirements (e.g. vegetation type, geography) to improve the implementation and delivery of fire management activities.
Bulk Water Carrier	A large tanker used for replenishing firefighting appliances with water.
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires, and scrub fires.
Bushfire Management Committee (BMC)	Formed under the <i>Fire and Emergency Services Act 2005</i> , Bushfire Management Committees are responsible for the governance, planning and coordination of local fire prevention work. Responsible for the development of Bushfire Management Area Plans. A total of 9 Bushfire Management Committees exist across the state, reporting to a central State Bushfire Coordination Committee.
Bushfire Management Area Plan (BMAP)	Developed by Bushfire Management Committees as a requirement under the <i>Fire and Emergency Services Act 2005</i> .
Bushfire Survival Plan	Also known as a Bushfire Action Plan. A pre-prepared plan developed by those who live, visit or work in a bushfire prone area, encompassing the decision to either Leave Early or to Stay and Defend to ensure that they are prepared and know what to do in the event of a bushfire (CFS 2009).
Canopy fuel	The crowns (leaves and fine twigs) of the tallest layer of trees in a forest or woodland. Not measured as part of the overall fuel hazard assessment (DENR 2011b).
CFS	The South Australian Country Fire Service.
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
DEWNR	The South Australian Department of Environment, Water and Natural Resources.
Direct attack	A method of bushfire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge, which becomes the control line.

TERM	DEFINITION
Ecological Fire Management	The active use of fire in nominated areas to achieve specified ecological objectives.
Elevated Fuel	Shrubs and juvenile understorey plants up to 3 m in height (DENR 2011b).
EPBC Act	The Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
Fine fuels/ vegetation	Grass, leaves, bark and twigs less than 6 mm in diameter.
Fire access track	A track constructed and maintained expressly for fire management purposes.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather, and topography.
Firebreak	An area or strip of land where vegetation has been removed or modified to reduce the risk of fires starting and reduce the intensity and rate of spread of fires that may occur (GAFMWG 2014).
Fire danger	The combination of all factors, which determine whether fires start, spread, and do damage, and whether and to what extent they can be controlled.
Fire frequency	The number of fires that have occurred on the same area over a time period.
Fire intensity	The rate of energy or heat release per unit time per unit length of fire front, usually expressed in kilowatts per metre (kw/m) (Pausas et al. 2003).
Fire interval	The interval between successive fires.
Fire management	All activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives.
Fire regime	The history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent, and seasonality of burning (Brooks et al. 2004).
Fire season	The period(s) of the year during which fires are likely to occur, spread, and do sufficient damage to warrant organised fire control.
Fire severity	The effect of fire on an ecosystem, that is, on living plants, as well as on the amount and location of organic matter consumed during a fire (Pausas et al. 2003).
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
Fuel	Any material such as grass, leaf litter, and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.
Fuel hazard	The overall fuel hazard is defined as the sum of the influences of bark fuel, elevated fuel, and surface fine fuel (DENR 2011b).
Fuel management	Modification of fuels by prescribed burning, or other means.
GAFMWG	South Australian Government Agencies Fire Management Working Group.
Heritage Agreement	Private conservation areas established through an agreement between the SA Minister for Environment and Conservation and the landholder under the Native Vegetation Act 1991.

TERM	DEFINITION
Incident Controller (IC)	The individual responsible for the management of all incident operations and the IMT.
Incident Management Team (IMT)	Incident Management Team. The group of incident management personnel comprising the IC and the people he/she appoints to be responsible for the functions of the Australasian Inter-service Incident Management System.
Included lands	The proclaimed reserves and Crown lands managed by DEWNR or a Co-management Board that are located within the planning area, and Heritage Agreements where the owners have agreed to participate in this plan.
Key Fire Response Species (KFRS)	These are the species most susceptible to decline due to inappropriate fire regimes: either too frequent or too infrequent fire, low or very high intensity fire, or fire in a particular season.
Life history	The combination of attributes with respect to growth, shelter, food/nutrients, and reproduction which determine species' requirements for existence (FEWG 2004).
Major Track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be a minimum of 7 m wide and sufficiently clear of vegetation both sides and overhead to allow ready two-way access (GAFMWG 2014).
Mechanical removal	Physical modification of flammable material to reduce fuel hazard levels through selective logging, thinning, clearing, slashing, mowing, and trimming of vegetation using machinery or equipment.
Minor Track	A track designed, constructed and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be 4 to 5 m wide and sufficiently clear of vegetation both sides and overhead to permit single lane access (GAFMWG 2014).
Minimum Impact Suppression Techniques	Achieving fire management objectives using methods that are consistent with land and resource management objectives. When determining an appropriate suppression response, consideration will be given to undertaking suppression with greater sensitivity and the long-term effects (WFLLC 2003).
Near surface fuel	Grasses, low shrubs, and heath, sometimes containing suspended components (leaves, bark and/or twigs).
NPW Act	The South Australian National Parks and Wildlife Act 1972.
NRM	Natural Resources Management.
Native Vegetation Council	Established under the provisions of the Native Vegetation Act 1991, responsible for making decisions on a wide range of matters concerning native vegetation in SA (DWLBC 2006).
Patchiness	The uneven distribution of fire regime across an area. Patchiness can be used to describe variability within a single burn area or variability between burn areas across a landscape.
Preparedness	All activities undertaken in advance of an incident to decrease the impact, extent, and severity of the incident and to ensure a more effective response.
Prescribed Burn Plan	The plan, which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.

TERM	DEFINITION
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.
Risk assessment	Used in DEWNR fire planning to assist in evaluating the threat to life, property, and environmental assets posed by bushfire and also to aid in developing strategies and works for risk mitigation. Considers Likelihood and Consequence to determine an overall risk rating through a matrix (DEWNR 2015b).
SAAL	South Australian Arid Lands. A management region of the Department of Environment, Water and Natural Resources.
Service Track	All other access tracks which are not maintained to the Major, Standard, or Minor Track requirements and therefore may not be trafficable or appropriate to use for fire management purposes (GAFMWG 2014).
sp.	Species.
Spotting	The ignition of spot fires from sparks or embers.
spp.	Species (plural).
ssp.	Subspecies.
Standard Track	A track designed, constructed, and maintained for the safe passage of firefighting vehicles undertaking fire management activities. Track shall be 4 to 5 m wide, sufficiently clear of vegetation both sides and overhead, and incorporate passing bays (a minimum of 17 m long and up to 6 m wide) every 400 m or less (GAFMWG 2014).
Surface Fuel	Otherwise known as 'litter'. Comprised of leaves, twigs, and bark on the ground (DENR 2011b).
Total Fire Ban	A ban on lighting and maintaining of a fire in the open, which can be invoked at any time during the year. When invoked, the Total Fire Ban is imposed for a period of 24 hours (from midnight to midnight) but may also be imposed for part of a day or days (Country Fire Service Regulations, 2003).
TPC	The Threshold of Potential Concern is defined as a point in time where Key Fire Response Species are likely to be affected by an aspect of fire regime.
Vital Attributes	Vital attributes are the key life history features that determine how a species lives and reproduces. With respect to fire, these attributes govern how a species responds to fire and/or persists within a particular fire regime (FEWG 2004).

Unless otherwise indicated, definitions have been sourced from the DEH Fire Glossary (2005a) or the AFAC Bushfire Glossary (AFAC 2012).



Department of Environment,
Water and Natural Resources



National Parks
South Australia